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HANDS ON: SWAP GEARS IN A MOPAR AXLE

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488CI FE STROKER
1,000HP SUPERCHARGED 460
500CI JUNKYARD CADDY BUILD
950HP TURBO LSX

FAST PONCHO: BIG-BLOCK-POWERED GRAND PRIX

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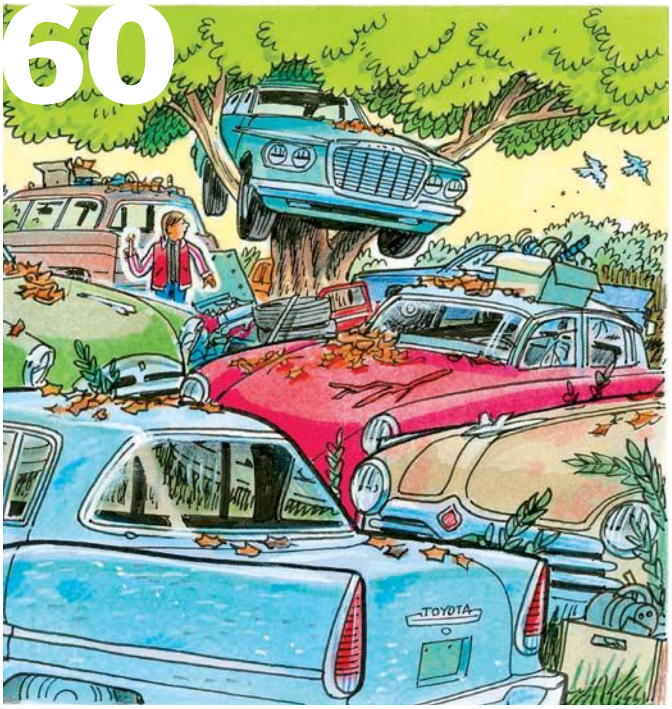

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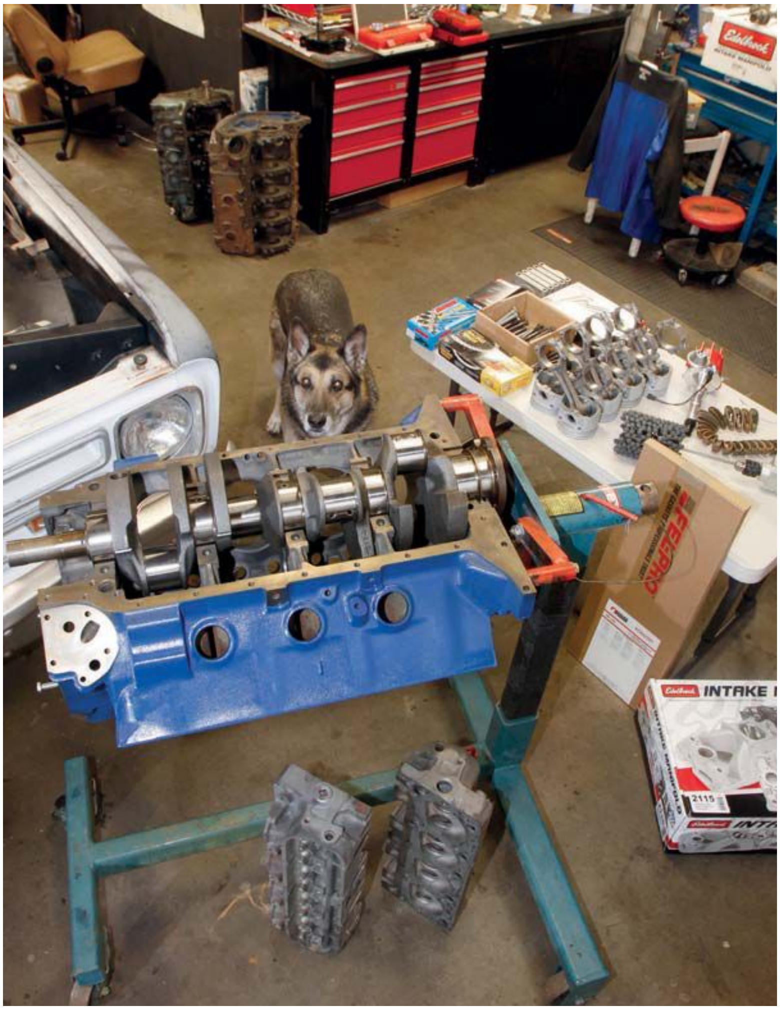

PHOTO-SHOOT TRICKERY

I get asked a lot of questions about my job from friends, family, and readers alike, and it's interesting to note the one consistent question I field is, "Who takes the pictures of you when you're in the magazine?"

"It's pretty easy," I usually reply. "The camera is on a tripod; I just set the timer."

Like everything in life, there's a lot more to it, of course. To get this month's cover picture, I'm using three strobes: one mounted on the camera, the other two triggered by the main light, mounted on the camera. That main light is aimed at the ceiling, bouncing off of it to provide a wide pool of light in the room. The second flash is pointed at a white reflector behind and to the right of this picture, creating a large light source to highlight the important stuff in the foreground, namely the engine block and cylinder heads. The third flash is positioned about waist high to the left of the engine and makes the engine and heads stand out even more from the background.

We run a pretty low-buck operation here at the **Car Craft**, so instead of fancy light stands and other equipment, I make do with what I've got. My camera is clamped to the top of an 8-foot ladder. I don't have the correct cable release for it, so I have to run into and out of the picture to press the shutter button. My "reflector" is a white bed sheet hung on a stretch of rope running the width of the warehome just behind where this picture was taken. And instead of cool (read: expensive) wireless triggers for the strobes, I'm relying on the weak signal from the main flash. The two slaves must be close enough and angled the right way, relative to the main flash, or they won't fire. It took a lot of trial and error to get all the elements right.

Oh, and even the stuff in the picture isn't quite what it seems. For example, the crankshaft is sitting on strips of cardboard I cut to fit the saddles in the block. The main bearings didn't arrive in time for the shoot. Notice the yellow and black box of piston rings on the white table? Those are 4.030-inch rings for a small-block Chevy. The Caddy's rings didn't get here in time, either. That was Ford blue I sprayed on the block. It was the darkest blue engine paint O'Reilly's had in stock, but it's still not dark enough to pass as Cadillac blue. Art Director Roberta Conroy darkened the engine paint in Photoshop after dropping the image in the cover layout. Instead of hiring sexy models, my dog, Culver, sometimes stands in. Like I said, we make do.

I'm not complaining, however. Without a doubt, this is a really fun and rewarding job. I wouldn't have stayed for so long otherwise. It's just interesting how much time can pass when engrossed in your work. With a greater transition to online content, this already fast-paced job has become even more so. Daily and weekly deadlines are now added to the traditional monthly deadlines. When we have a minute, it's always interesting to stop and think how much time and effort can go into something that looks so easy; in the case of my job, a single picture, a basic engine rebuild, or an event coverage article. When, in reality, there is so much going on behind the scenes. On top of that, it takes even more work to compile the text and photos, put them in a layout, and send it off to the printing press. The good news is that we're nearly done with this month's issue. Time to get started on the next.

—John McGann

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HORSEPOWER!

A passenger compartment heater serves no purpose on a dedicated race car and simply adds unneeded weight, so Pontiac created a bolt-on panel to seal off the firewall area where the heater core is typically located.

As opposed to the stamped steel body panels used in production, Pontiac offered a number of facsimiles in stamped aluminum to shed about 200 total pounds of vehicle weight of a 1962 Catalina competing on the dragstrip. The front fenders, inner fender liners, and radiator support of this example are all constructed of stamped aluminum. Out of view are the aluminum hood and front bumper.

A pair of 625-cfm Carter AFB carburetors and a high-volume and high-pressure mechanic fuel pump fed the monstrous V8. PNs 3433S (front) and 3435S (rear) were specific to Pontiac's Super Duty and were identified by stamped aluminum tags. The louvered air cleaners resemble the larger unit found on the four-barrel GTOs that came later.

The foundation of the Super Duty 421 was a PN 538181 block with four-bolt main caps and a bore of 4.090 inches. Riding on the PN 542990 forged-steel crankshaft with 3.25-inch main journals and 4.00-inch stroke were PN 529238 forged-steel connecting rods and forged-aluminum pistons developed and produced for Pontiac by Mickey Thompson.

Pontiac used two cylinder heads during the 1962 model year—both with 68cc combustion chambers yielding a compression ratio of 11.0:1. Casting PN 540306 was carried over from 1961 and featured 1.92/1.66-inch valves and a peak intake airflow capacity of about 210 cfm. Casting PN 544127 was introduced in March 1962 and featured larger ports and oversized 2.02/1.76-inch valves, which improved peak airflow to about 230 cfm. Despite the added airflow, Pontiac maintained the Super Duty 421's 405hp rating.

A LOOK BACK AT PONTIAC'S POTENT 405HP 1962 SUPER DUTY 421

The early 1960s was an amazing era for performance enthusiasts. Just think about it—you could actually walk into your local dealership on a Monday morning and purchase a vehicle you watched professionally compete on an oval track or dragstrip the weekend before! Practically every manufacturer was hunting for that notoriety, and Pontiac poised itself as the team to beat during the 1962 model year with its factory-installed Super Duty 421. Conservatively rated at 405 gross horsepower at 5,600 rpm and 425 lb-ft of torque at 4,400 rpm, less than 200 of the purpose-built engines were installed into Catalinas and Grand Prixs that model year. Let's take a look at what makes it so unique.

By Rocky Rotella / Photos: Rocky Rotella

THE CAR

We caught up with Californian Mike Marsh in Omaha, Nebraska, in 2006 to photograph his Cameo Ivory 1962 Pontiac Catalina originally equipped with the Super Duty 421 that you see here. The car had just 14,000 miles on its odometer then and was very much a surviving timepiece. Typical of cars raced competitively during that era, some of its original engine components were swapped out, but previous owners painstakingly returned it back to factory stock over the years. A full write-up appeared in the April 2007 issue of *High Performance Pontiac* magazine, and it can be viewed at HotRod.com (search "Survival of the Quickest"). It has changed hands since the time our feature story originally ran nearly 10 years ago.

A Delco PN 1110976 dual-point distributor without vacuum advance ignites the combustible cocktail within each cylinder.

Beneath the Super Duty–specific valve covers resided a set of stamped-steel rocker arms in 1.65:1 ratio, flat-tappet mechanical lifters, and a PN 541596 "McKellar No. 10" camshaft advertised at 308/320 degrees of duration and nearly 0.450-inch valve lift.

Pontiac utilized a few different dual-quad intake manifolds in 1962. Casting 542991 was teamed with the No. 306 cylinder head early on, while PN 9770319 was equipped with larger runners to complement those of the No. 127 head. Both were equipped with an exhaust crossover, but it was nonfunctional. Casting 9770859 was introduced very late in the 1962 model year and may have never been factory-installed and instead was available for racers/owners for installation. It contained no exhaust crossover at all.

The Super Duty 421 included a pair of highly efficient, cast-iron exhaust headers that contained separate bolt-on collectors with cutouts to bypass the 2.25-inch dual-exhaust system and low-restriction mufflers. Late in the 1962 model year, Pontiac produced the headers in cast-aluminum to reduce overall vehicle weight, and some owners/racers installed them (as is the case here). As the aluminum was susceptible to heat erosion if continually subjected to extended run time, the cast-aluminum units were intended for quarter-mile competition only.

SPEED PARTS

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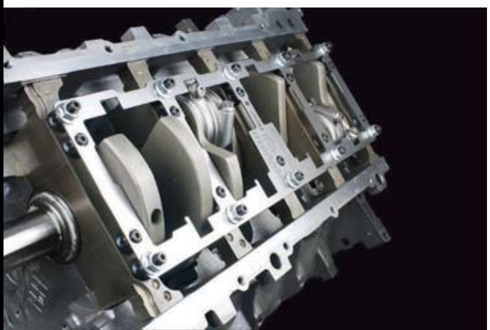
What it is: Ultra-responsive air/fuel gauges.
Why you care: For optimum tuning, whether carbureted or fuel injected, the most accurate tune-up requires the most accurate oxygen sensors, and these new units from AEM Electronics help you get closer to the ideal tune-up. AEM claims these have the fastest response times in the business, meaning there is virtually no delay between the sensor's reading of the exhaust and the display on the gauge. This is especially important when tuning your air/fuel ratio at high rpm. The gauge fits a standard 2$^{1}/_{16}$-inch mount. You can choose to display in Lambda or percentage of oxygen, and an output port is included to connect with a data logger. The gauge can be calibrated to read gasoline, E85, ethanol, and methanol.
How much: $259.98
Learn more: AEM Electronics; 310/484-2322; AEMelectronics.com

LESS WINDAGE MEANS MORE POWER

What it is: A crankshaft scraper for LS engines.
Why you care: Because of their deep-skirt engine block, LS engines can experience windage problems, especially at high rpm. A crankshaft scraper can help alleviate those problems and free up some horsepower in the process. Improved Racing offers crank scrapers for the LS engine in stock stroke and aftermarket crankshafts with up to 4 inches of stroke. The company's testing has shown an increase of about 8 hp at the wheels of a fifth-gen Camaro, but the real benefit is improved oil control.
How much: $70
Learn more: Improved Racing; 407/705-3054; ImprovedRacing.com



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What it is: Trailing arm relocation brackets for 2005–2014 Mustangs.
Why you care: Mustang experts Maximum Motorsports developed these bolt-on rear suspension relocation brackets for S197 Mustangs. They help improve traction by changing the angle of the rear trailing arms and are especially useful on cars that have been lowered. These brackets maintain the Panhard bar in the stock location, but allow the trailing arms to be mounted in several locations based on the desired geometry.
How much: $199.97
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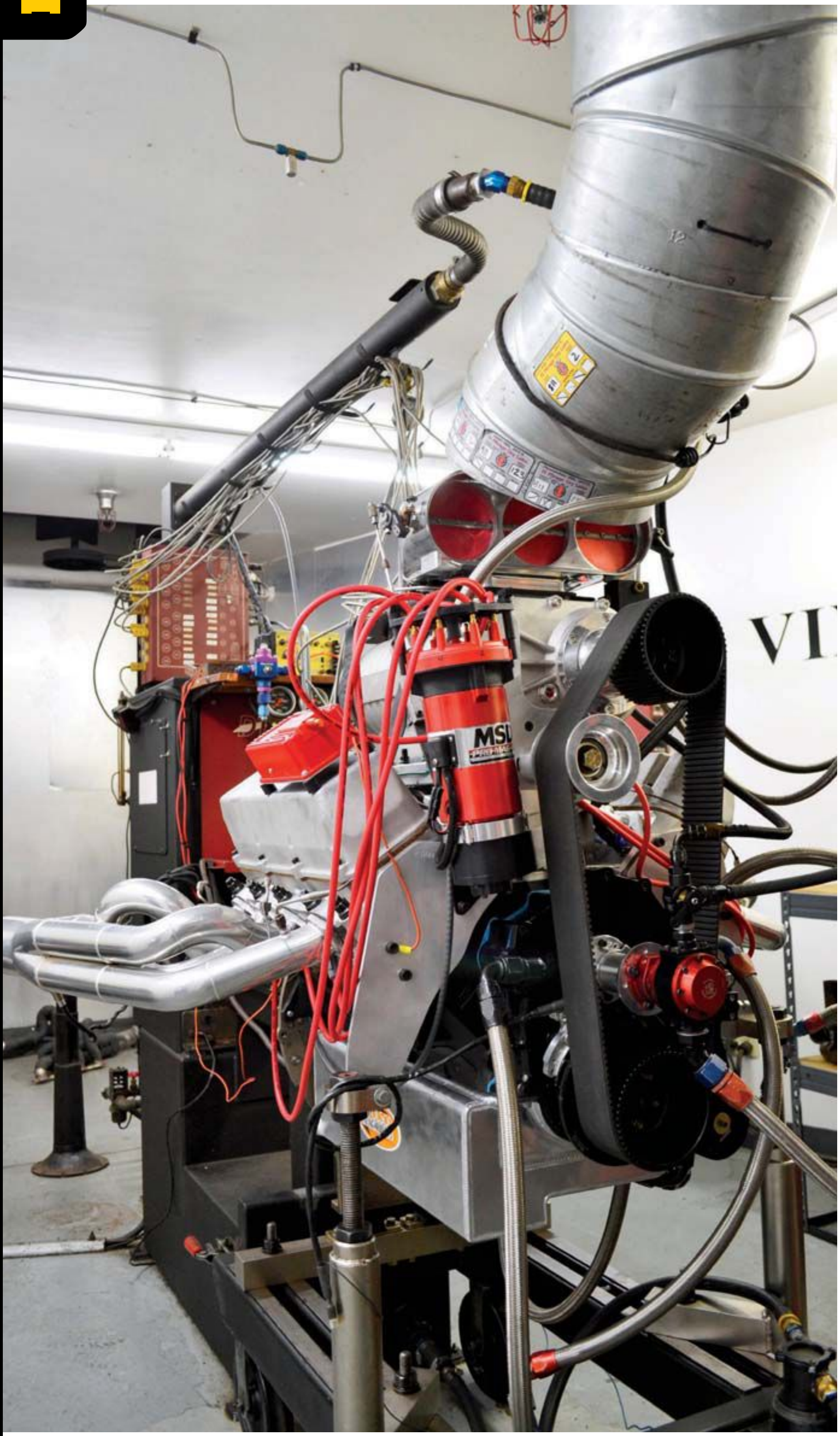
HANDS ON

DYNO DISSECTION

Tuning a 1,194HP, 598CI Ford

By Jason Sands / Photos by Jason Sands



It's not often you come across an opportunity to witness a big-inch Ford engine on a dyno, much less one that's a whopping 598 ci and force-fed by a Whipple supercharger. The big-block Ford was the brainchild of Vintage Hot Rod Design and Fabrication, John Beck Racing Engines, and Chet Thomas, and would be powering Chet's land-speed 1932 roadster. The idea was to build a powerplant that could be hammered-down for an obscene amount of time without the engine blowing up. You know how drag racers worry about their quarter-mile tune-up? Try it for 5 miles. Due to class rules, the Ford would also be blown on gas, which is notoriously temperamental. Yeah, we couldn't pass this one up.

THE HOMEBUILT, 598-CID FORD

It's not that Chet doesn't like Chevys (he has an LS-powered '55), he's just one of those guys who believes Fords should power Fords and Chevys should power Chevys. With Ford 460-based engines having aftermarket support in the form of aftermarket blocks, heads, and virtually everything else, he saw no reason why his 1932 roadster couldn't be Ford-powered.

The whole buildup was centered around survival. "Big hammer for a small nail," said engine builder John Beck. That meant a relatively simple setup that was big on displacement and mild on boost. The build started with an A460 block from Ford racing that was filled with an Eagle crank and connecting rods and custom Arias 7.9:1 pistons. A set of high-flowing Trick Flow Power Port 360 heads that flow 453 cfm on the intake side and 321 cfm on the exhaust at 0.800-inch lift were chosen for the application and mated to a relatively mild 272/279 (at 0.050), 0.727 lift Competition Cams roller camshaft. Supplying boost to the big Ford is a Whipple 510R supercharger, which flows a tornado-like

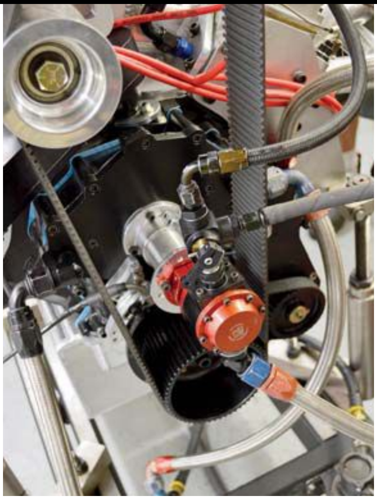
3,250 cfm at maximum rotor speed. Induction was the big deviation from the norm, as an injected setup was used rather than carburetors. The system started with a Waterman fuel pump, which then sent race gas to an Enderle Birdcatcher hat and injection system. The big Ford was lit off with a MSD 20 amp Pro Mag and Mike Dunn offset mag drive.

DYNO TUNING AND INITIAL ADJUSTMENTS

With a one-off engine, it pays to be careful, so the big Blue Oval was warmed up and given a once over before any pulls were made. A minor water leak was found after the engine was fired, and the crank trigger wasn't reading right, so the magneto was put on a switch outside the dyno room. The trial fuel pills in the hat were also jetted to be extremely rich, as rich trumps lean any day when trying to dial in a tune. The big Whipple blower was also an unknown quantity, as final drive ratios would be a lot different than the 14-71 blowers the team was used to running. The crankshaft and blower pulleys, like everything else, would be a conservative guess. Before the engine was even run on the dyno, it was given a few quick raps. The dyno loads the engine hard, so the air/fuel ratio would go slightly lean, before the engine got into the meat of its powerband. Still, tuner John Beck got the jetting close enough where a full pull could be made.

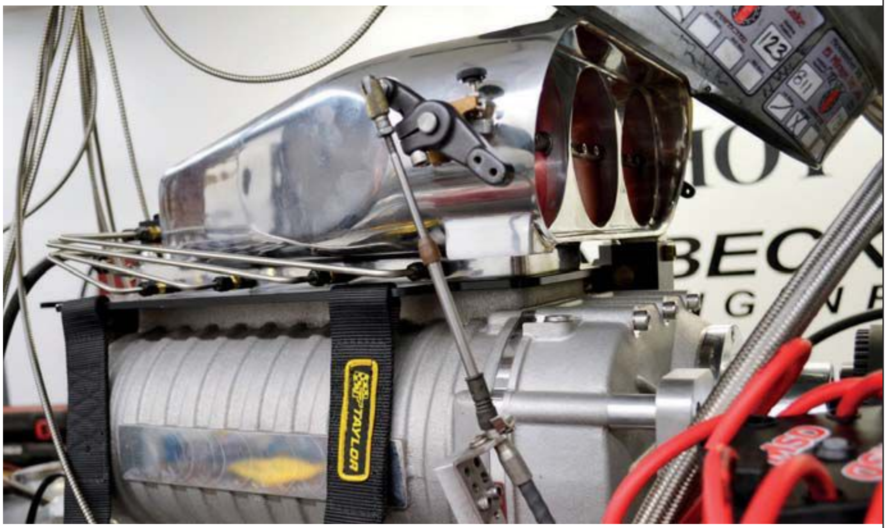
DYNO RUN 1: 889 HP, 878 LB-FT

We were expecting the first run to be safe, but holy 9.8:1 air/fuel ratio! While the combination was unique, we could see the air/fuel ratio was way too safe and the boost was way too low for the engine's 7.9:1 compression ratio. We were hoping for about 12 psi, but the pulleys were way off. With only 7.2 psi, we were basically at overly rich, naturally aspirated levels of horsepower. The timing was pretty aggressive (35 degrees), but this wasn't a 30-psi turbo motor. We'd be looking to make power and low exhaust gas temperatures for 5 miles.

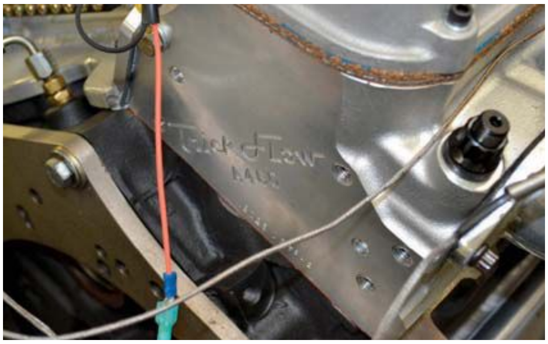


A lot of custom parts were built for the blown Ford application. With the help of his sons at Pleasanton Tool and Manufacturing, owner Chet Thomas built the front cover and accessory drive, which drives the Waterman fuel pump that supplies the big Ford with fuel.

To light off the supercharged air/fuel mixture, a trick MSD magneto and Mike Dunn offset drive was incorporated into the engine build. The MSD supplies the wires and plugs with a whopping 20 amps of power.



The crown on the top of the big Ford is a Whipple 510R supercharger, which is capable of flowing 3,250 cfm at full tilt. The Whipple is fed by an Enderle Birdcatcher mechanical-injection system that flows an even wilder 4,600 cfm—more than enough for the 598-cid engine.



Airflow is important in a blown engine, but ultra-trick heads can usually be bypassed since the supercharger does a lot of the work. A set of out-of-the-box Trick Flow 360cc runner heads were installed (the largest they make), but a CNC porting job wasn't deemed necessary for this application.

Since the engine was going to be installed in a roadster, the same headers that were run on the dyno could be installed on the car, a set of 2⅛-inch primary units with 4-inch collectors.

A custom dry-sump pan from Dan Olson Racing Products was built for the big-block and incorporates a 14-quart reservoir to help keep the oil clean and cool.

When the Ford was first fired up, engine builder John Beck performed a number of routine tasks like checking the oil, water, head-stud torque, and valve lash to make sure everything was well within specs.

Left: Once the dyno pulls started, John checked the plugs every couple pulls to ensure there wasn't a problem waiting to happen.

DYNO RUN 2: 907 HP, 867 LB-FT

The first step was to lean the engine out and see how it liked it. The beauty of a blown gas engine is that major jet changes are done by simply changing the main jet, which changes the entire fuel curve. Since we were taking baby steps, a change in jetting from 0.130 to 0.135 picked up a quick 18 hp and power kept climbing until 6,000 rpm, where the test was stopped. With boost still only at 7 psi, it was time to pulley up.

DYNO RUN 3: 951 HP, 910 LB-FT

To be safe, the main jet was reduced to a 0.125, which would richen the engine back up, even with the addition of a pulley change. John told us he'd rather stay on the rich side than the other way around, and added that blown gas engines usually like quite a bit of fuel. With the bottom pulley changed from a 56-tooth pulley to a 63-tooth unit, another pull was made. The engine responded with the extra boost (now at 10.5 psi) and power picked up again—to 951 hp. Because the goal was 1,100 hp or more and John felt he had a handle on how the engine was responding, the next step would involve dropping the top pulley from a 53-tooth piece to a 49-tooth unit, which we hoped would mean a big jump in boost. With the air/fuel ratio at a way-rich 9.5:1, the pulley change was made with no additional jetting change.

DYNO RUN 4: 1,109 HP, 1,029 LB-FT

OK, now we were talking. With the boost up at an even 13 psi and the engine's air/fuel still at a safe 10.5:1, the double whammy of leaning out the engine and adding 3 psi gave an impressive 158hp increase over the previous test. With torque peaking at 5,100 rpm and boost at still very moderate levels, this would make one heck of a pump-gas combination with a little tuning.

Virtually all of the fuel-system adjustments were made by changing the main jet. The main jet size determines how much fuel is bypassed back to the tank, so a change to the entire fuel curve can be performed in one simple step.

The other part of the engine that contributes to the fuel curve is the pump. As you can tell by the numbers on this data sheet, fuel pressure rises with rpm, which maintains a consistent air/fuel mixture as the blower makes more and more boost.

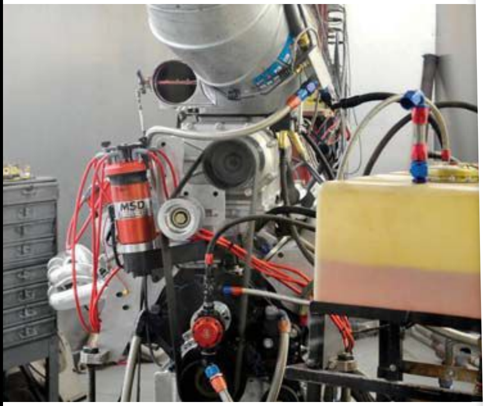
DYNO RUN 5: 1,177 HP, 1,051 LB-FT

Although we were a little nervous about it, John insisted that bumping the timing up to 40 degrees would give a big jump in power without any danger of detonation. "We used to run 50 psi and 40 degrees in our blown-hydro days," John said. With good gas as a detonation deterrent and the efficient Whipple blower, the engine gained 68 hp up top at the same boost level.

DYNO RUN 6: 1,194 HP, 1,062 LB-FT

On run number six, the last set of pulleys we had on hand (48-tooth top, 63 bottom, or 30 percent overdrive) was swapped on. The engine responded again, with more power and torque throughout the rpm range. The 598 peaked at an impressive 1,194 hp at 14.8 psi of boost, with more than 1,000 lb-ft of torque throughout virtually the entire dyno range. We didn't know it yet, but this was going to be our best pull.

After only six dyno pulls, the 598-cid Ford had put down 1,194 hp and 1,058 lb-ft of torque, which made for one very happy owner!



DYNO RUN 7: 1,171 HP, 1,058 LB-FT

On the last and final dyno run before the engine would be strapped into the car, the main jet was changed to a 0.130 to lean the engine out and the engine was spun up to 6,800 rpm, up from its previous peak of 6,400 rpm. The results were a bit odd, as with a much leaner 11.4:1 air/fuel ratio the engine made more torque (1,058 lb-ft at 5,000 rpm) but made less power at its peak. Adding another 400 rpm on top of the powerband also didn't add power, but it didn't fall off, either, which was good to know. With owner Chet Thomas' power goal of 1,100 hp met (and then some), the dyno session was concluded and it was time for the 598 to be installed in Chet's roadster.

A number of pulley changes were made to increase blower speed during the dyno runs. While we peaked at a 30 percent overdrive in this application, the math told us we could run almost 70 percent if we need to make more power.

FINAL THOUGHTS ON DYNO RUNS 1–7

While it's easy to concentrate on final peak numbers, the road it took to gain an additional 305 hp and 180 lb-ft of torque was pretty interesting. There were some points where the engine picked up more than we thought it might (like the jump from 10 to 13 psi) and other spots where it gained as much as we thought (like increasing the engine's peak rpm). There was still also the fact that we were barely leaning on the big Whipple, as a 30 percent overdrive was still only a 9,100-rpm blower speed at 7,000 engine rpm.

→SOURCES

Enderle Fuel Injection; 800/576-7661; GoodVibesRacing.com
MSD; 915/855-7123; MSDperformance.com
Trick Flow Specialties; 888/841-6656; TrickFlow.com
Vintage Hot Rod Design and Fabrication; 530/343-9228; VintageHotRod.com
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STROKING THE SIDE OILER

488 CI of FE Ford Bangs Out 676 LB-FT of Torque!

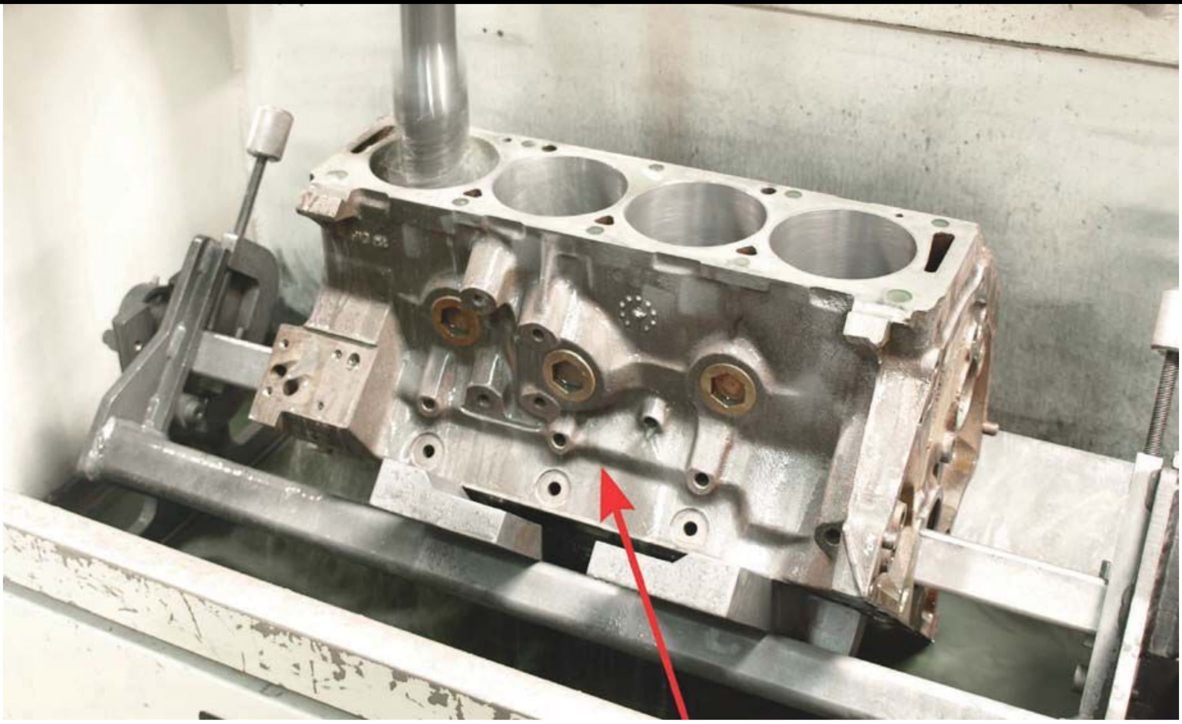
By Steve Magnante / Photos: Steve Magnante

Once upon a time, more than half a century ago, before Corvettes and stroked small-blocks clouded the waters, the number 427 stood for one—and only *one*—thing: Ford's ultimate factory weapon on the NASCAR superspeedway battlefront. An outgrowth of the new-for-1958 FE series big-block V8 engine family, the 427, emerged in 1963 as an extension of the performance-oriented 406 and instantly swept the *top five* winning spots at the 1963 Daytona 500. Ford really was First On Race Day!

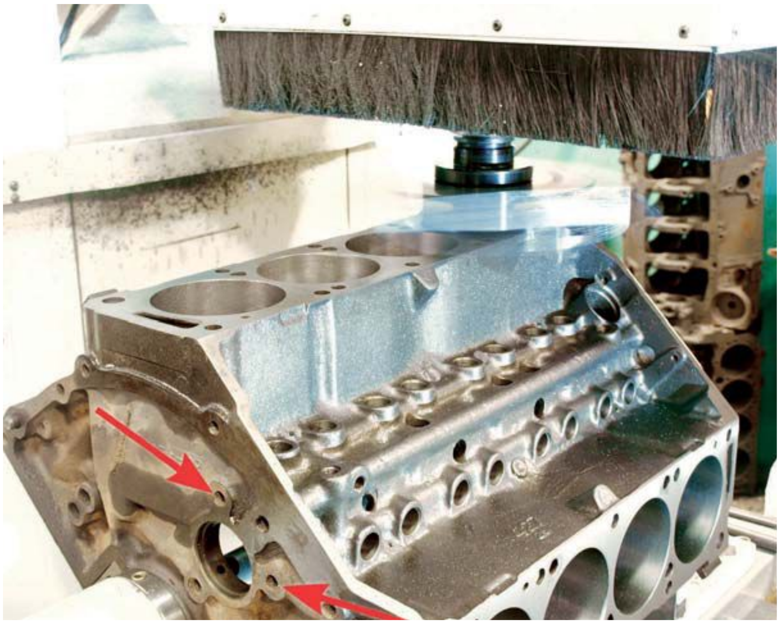
Winning driver Tiny Lund's 427 Galaxie hammered along at an average of 151.556 mph, cementing the Ford 427 in NASCAR race history forever. But as stout as the 427 was, by 1965, its oiling system proved to be a weak link in all-out race situations. Shared with every other FE big-block—from the base 352 two-barrel up to the triple-carb 390 in Uncle Jimmy's 1963 T-bird Sports Roadster—the early 427 oiling system routed pressurized oil from the pump and filter to a longitudinally positioned oil galley positioned above the cam tunnel.

From here, oil flow was divided. Half (roughly) went up to the lifters and rocker arms, and half went down to the camshaft journals and main bearing journals. In normal driving situations and most street and strip applications, the system was adequate. But with the arrival of things like Ford's "7,000 rpm kit," high-riser heads, and ultra-tall eight-barrel induction systems (which forced the use of "teardrop" hood-clearance blisters on the 1964 Fairlane Thunderbolt), above 6,500 sustained rpm, 427 racers began kicking rods and ventilating blocks. More oil flow was needed.

To remedy the situation, in early 1965, Ford revised the 427 oiling system to replace the cam-priority



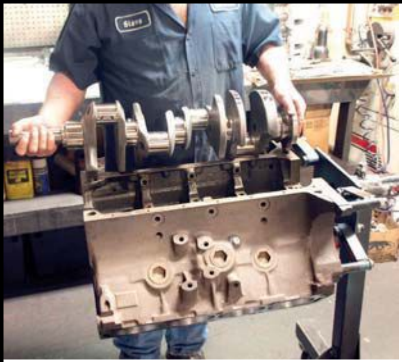
After boring with a torque plate, the Rottler power hone takes the bores from 4.230 to 4.280 inches. The raised horizontal rib above the passenger-side oil-pan rail (*see arrow*) gives the side-oiler block its name.



Never before decked, the R.A.D. Rottler F79A removed 0.008 and 0.014 (passenger side/driver side) to establish the correct and even deck height. Despite numerous cylinder replacement sleeves, the block passed all pressure and crack tests before machine work began. The twin oil galley access holes adjacent to the rear cam tunnel plug (*see arrows*) indicate this 427 was factory machined with full-length camshaft oil galleys. Only found on industrial, marine, and 1968-model-year blocks, they allow the choice of solid or hydraulic lifters. In this hydraulic-roller-cam-equipped build, they'll be left as-is. If a solid cam was in the plan, the internal oil galleys would have to be plugged to prevent unwanted/unnecessary oil flow to the solid lifters.

Working with the 0.050 cylinder overbore, the stock 3.78 stroke Ford crank gives way to a 4.250 inch 4340 forged steel replacement from Scat (PN 4FE200) that weighs 63.6 pounds and is internally balanced. Scat also offers a cast-iron version (PN 9FE200, 59.6 pounds) for penny-pinchers. Scat 6.700-inch rods and lightweight J&E forged pistons (521 grams each, PN 242931) complete the rotating assembly.

To minimize the swing arc of rotating parts inside the crankcase, the Scat H-beam rods (*bottom*) feature downsized big-end diameters (from 2.43 to 2.20) and compact ARP-sourced rod bolts. The stock rod shown is a C3AE-C 1963–1965 Ford 427 item that uses a two-piece bolt and nut fastener. Only the 427 LeMans rods had cap screws, taking their name from the famed 24-hour French road race where Ford defeated Ferrari for four consecutive years (1966–1969) with a fleet of 427-powered GT40s.



The compact stroker assembly is so well engineered that zero clearance grinding work is required inside the block. Scat's forged stroker crank features hollow main journals (the cast version is solid in this location). Both types feature fully radiused, cross-drilled, and chamfered journals. Note the 427-only screw-in core plugs; lesser FE blocks use conventional press-fit cupped plugs.

Designed to prevent the cumulative effect of cap walk from degrading the oil wedge in endurance race applications like the Daytona 500 and 24 Hours of LeMans, the 427's cross-bolted main caps are not strictly necessary on a street and strip machine. The factory two-bolt caps used on 332-428 FE blocks are sufficient. That said, there's nothing cooler than spotting the 427's trio of extra bolts over the oil-pan rail on cruise night!

"top-oiler" configuration with a main-priority setup, and the trouble ended. In particular, the 427's main oil galley was repositioned from above the cam tunnel to the passenger side of the block so pressurized oil was made available to the mains *before* the top end. The revised 427 has come to be known as the side oiler and, as we'll see, can easily be identified visually.

In this story, let's watch as Donnie Wood and the team at R.A.D. Auto Machine revive a dormant 427 side oiler while bringing it into the "stroker age" with a Scat long-arm kit and a set of Edelbrock heads. The resulting 561 hp is probably 100 clicks higher than what Tiny Lund had under foot back in 1963. As for the 676.2 lb-ft of torque, we'd wager that's almost 200 twisters more than the old days. Best of all, we don't have to crank it up to 7,000 rpm to get the goods! Revs might be fun, but they generally eat lower end and valvetrain parts—sooner or later.

Unlike the one-piece main caps used on the Chrysler 426 Hemi, Ford's deep-skirt cross-bolt arrangement employs hardened steel spacers between the caps and block. Specifically machined, then Blanchard ground for a precise fit, you don't want to mix them up! Fully grooved main bearings from Clevite (PN MS-863P) are used. This view inside the crankcase offers a look at the inner face of the side oiler's unique oil-galley routing (*see arrows*).

Fortunately, Ford stamped each spacer (R-1, R-2, R-3 and L-1, L-2, and L-3) to indicate its correct position. The oil-pan rails are also stamped with corresponding numbers (*see the 2-L marking in the picture above*). It's foolproof *if* you're working with an unmolested engine. The torque-down process is, main caps to 35 lb-ft, side bolts to 45 lb-ft, then main caps to 100 lb-ft. RTV thread sealant *must* be applied liberally under external washer heads to prevent oil leaks down the side of the block.

Piston installation must suit the E-I-E-I-I-E-I-E valve-head sequence or contact will result. The J&E forged slugs have inverted domes and 0.250-inch-deep valve-relief pockets to deliver 9.9:1 compression. The 0.990-inch floating pins are retained with double Spiro-Locks, and there is no pin-offset designed into the piston body.

This marine block's drilled camshaft oil galleys open the door to a hydraulic cam. A Comp Cams Thumper hydraulic roller (PN 33-601-9) was selected to eliminate valve-lash adjustment. Specs are 0.577/0.561 lift, 292/311 advance duration, 235/249 duration at 0.050, 107-degree lobe-separation angle. R.A.D. installed it "straight up" after confirming machining accuracy with a degree wheel. If your 427 block lacks upper oil galleys, sorry, pal—your only choice is a solid cam. But is that really so bad?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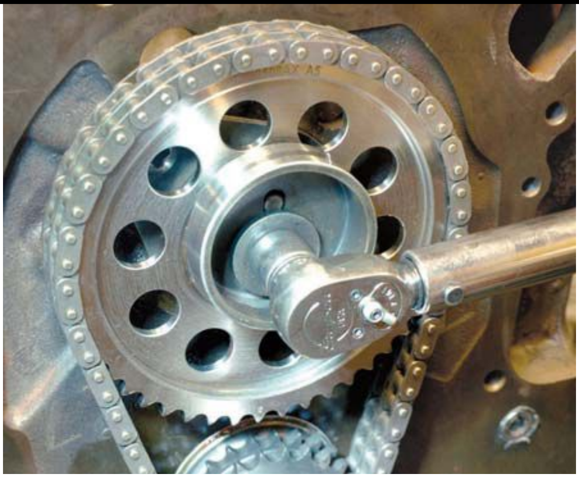


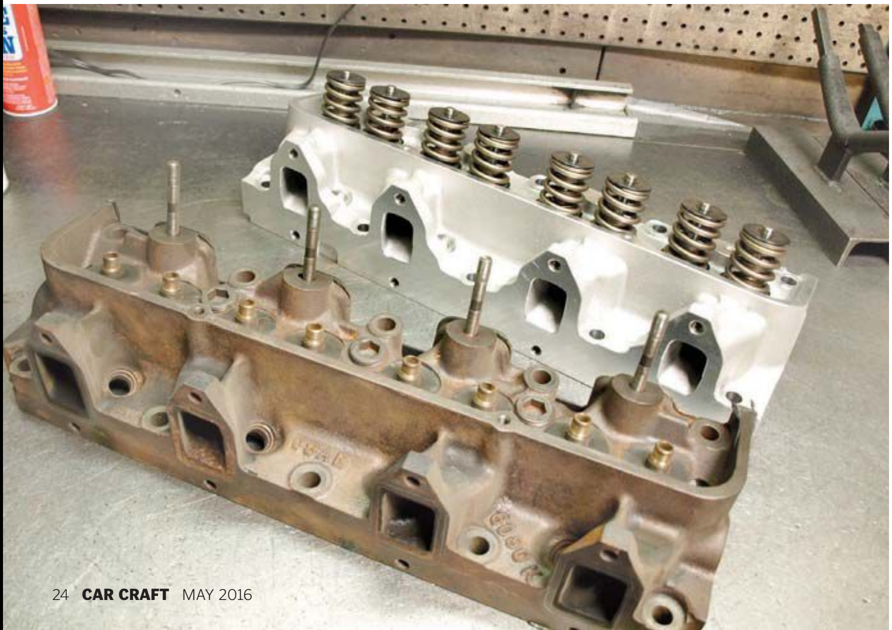
The Comp Cams Thumper is a single-bolt design, which goes to 75 lb-ft. The timing set is a double row roller from Liberty Performance (PN LT98508T-9) with the all-important one-piece rollers. *Never* use a timing chain with thin, formed sheet rollers. If you see a seam in each roller, junk it immediately. One-piece, machined rollers are the only way to go.

Oil-pump selection can save power. R.A.D. testing has shown that a high-pressure pump can consume as much as 6 hp while delivering unhealthy 130-psi pressure levels. A standard-grade Melling pump is adequate for this sub-6,000-rpm torquer. Again, despite nearly an extra half inch of stroke, no crankcase grinding was required to clear the Scat stroker kit.

The stock 427 oil pan holds 6 quarts and includes an anti-surge baffle to keep the pickup submerged on hard acceleration. Large, full-length windage trays are ideally suited to deep-skirt block configurations like the Ford FE and Chrysler big-block. But they're controversial in street and strip applications like this. Critics say they're just as effective at keeping oil from returning to the sump as they are at keeping oil from contacting the spinning crank. To eliminate the hassle of clearancing a tray to suit this stroker, R.A.D. simply left it out in this mild street and strip application.

The Comp hydraulic roller lifters are thoroughly immersed in an 80/20 mix of Joe Gibbs assembly lube and 20W-50 break-in oil. Besides certain non-automotive units, the only hydraulic cam factory 427 appeared in early 1968 with 390 hp and a single four-barrel. The 428 Cobra Jet replaced it in April 1968.

ARP ½-inch head studs (PN 155-4201) feature nifty Allen wrench receptacles to aid installation. Head nuts will go to 110 lb-ft. The FelPro head gaskets (PN 8554PT) compress to 0.041 inch and deliver nearly double the 0.028-inch safe minimum clearance between the zero-deck piston crowns and cylinder heads.



Left: Though the customer wanted to reuse his father's 1963 C3AE-K cast-iron 427 high-riser heads for sentimental reasons (*foreground*), the numerous cracks, damaged seats, worn guides, and O-rings posed too many hurdles. They'll be replaced with a set of Edelbrock Performer 427 low/medium-riser heads (PN 60079) to save 18 pounds (each).

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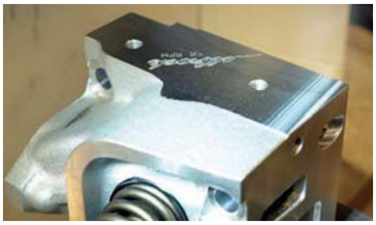
The Edelbrock heads feature 76cc chambers and deliver 9.9:1 compression with the reverse dome pistons. Their 170cc intake port openings measure 2.100x1.375 inches and flow 270 cfm at 0.600 lift and accept all non-high-riser intake manifolds. By contrast, the tall high-riser (*background*) intake ports are larger at 2.850x1.450 inches, but can only be mated to scarce high-riser intake manifolds.

To suit the hefty hydraulic roller lifters, a set of Comp Cams double valvesprings (with dampers) replace the single-coil Edelbrock items. At 1.840-inch installed height, they deliver 165 pounds on the seat and 430 pounds at 0.557-inch lift. The Edelbrock valves and chrome-moly retainers are reused. The 1.76:1 aluminum roller rockers are from Pro Comp (PN 261-1134) with lifter preload set at 0.040-inch ($3/4$ turn on each adjuster past zero lash).

Though dual-quads are slated for installation at a later date, for now a vintage Ford C7AE9425-F 427 single four-barrel intake manifold is used. A Quick Fuel Technology BDQ-850 carburetor with mechanical secondaries meters the fuel. Jetting is 76/84 (primary/secondary). Seasoned FE builders may notice the lack of the lifter valley tray. See the next picture for the reason why.

R.A.D. retained the Edelbrock 2.09/1.66-inch valves, but performed a little bowl blending beneath the unleaded-fuel-compatible valve-seat inserts. Like all Edelbrock Performer series aluminum Ford cylinder heads, the decks are $5/8$-inch thick for rigidity.

R.A.D. received this 427 as a wounded warrior in need of rebuilding. The pen points out scars on the lifter valley tray inflicted by previous efforts to use roller lifters. The tie bars contact the tray, so it must be omitted when solid or hydraulic roller lifters are used.



Though blasphemous to the if-you-got-it-flaunt-it set, the engine owner asked R.A.D. to remove the engraved Edelbrock logos for stealth points. He also had 'em painted black. Remember, before 1966 when Ford adopted its universal blue-engine policy, most sixes, small-block V8s, and big-block V8s were painted gloss black. The valve covers and air cleaners were then painted various colors (or chromed) to denote power level.

Ready for testing on the Land & Sea Dyno-Max 2000, a pair of FE pickup truck headers (installed upside-down) handle exhaust duty. A Mallory Unilite electronic distributor and Taylor silicone wires handle ignition with advance set at 34 degrees BTDC. With 561.5 peak horsepower coming in at a mere 5,100 rpm and 676.2 lb-ft at 3,900 rpm, the benefits of the 7,000-rpm NASCAR-intended side-oiler block may not be fully utilized, but nobody's complaining about the 427-only cross-bolted mains.

RPM	HP	Torque
3,000	376	654
3,200	407	669
3,400	434	670
3,600	459	669
3,800	488	675
4,000	513	674
4,200	527	659
4,400	537	642
4,600	550	628
4,800	558	611
5,000	563	590
5,200	561	566
5,400	546	531
5,600	534	501

→SOURCES

ARP; 800/826-3045; ARP-Bolts.com
Comp Cams; 800/999-0853; CompCams.com
Edelbrock; 310/320-2222; Edelbrock.com
J&E Pistons; 714/898-5114; JEPistons.com
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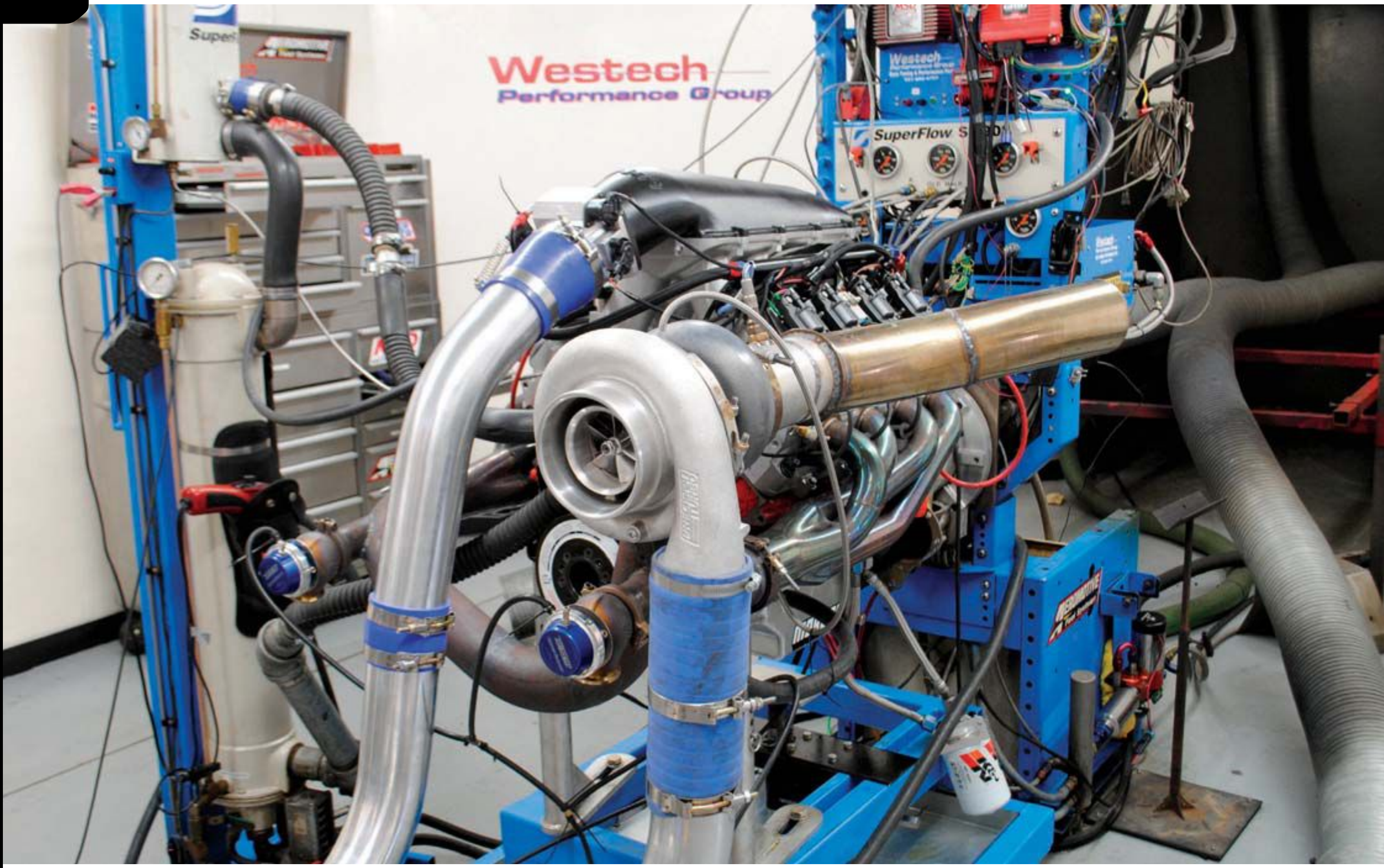
BEGGING FOR BOOST

We Add a Turbocharger to our Chevrolet Performance LSX376-B15 Crate Engine

By Richard Holdener / Photos: Richard Holdener

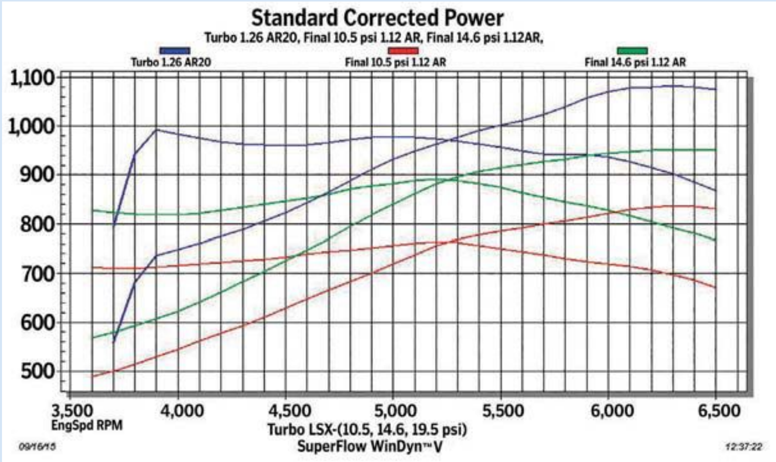


The LSX376-B15 crate engine has proven itself to be not only a capable performer but an LS platform literally begging for boost. Advertised by Chevrolet Performance to accept "up to 15 psi of boost" (thus the 15 in B15), we can say with absolute certainty that their suggested boost limitations were wildly conservative. In our last adventure with the B15, we pumped up the pressure to nearly 29 psi, effectively doubling the limit suggested by GM. The boosted B15 more than just survived, it thrived. After running multiple cam profiles with a 4.0L Whipple supercharger, we eventually cranked up the boost and made nearly 1,000 hp before belt slippage stepped in to ruin the pressure party. Though there was more power to be had with the twin-screw setup, we switch gears by swapping out the Whipple for a brand-new boost builder. Enter the turbocharged B15!

In truth, the B15 couldn't care less where the boost came from, but there were decided differences between the boost offered by a supercharger and a turbocharger. The major difference between the two methods of forced induction was the energy used to develop said boost. On a typical twin-screw supercharger, the rotors are driven directly off the crankshaft. Much like other accessories (A/C, power steering, or alternator), there are parasitic losses associated with driving the supercharger. The higher the power and boost level, the greater the power losses associated with driving the supercharger. That power is actually produced by the engine, but, unfortunately, absorbed by the blower. The end result is that the power is neither registered on the dyno nor available to accelerate your vehicle. By contrast, the turbo is driven off exhaust energy and, unless backpressure is excessively high, the losses associated with driving the impeller are minimal. A turbo will usually produce more power per pound of boost than a typical supercharger, with that differential increasing with pressure and output.

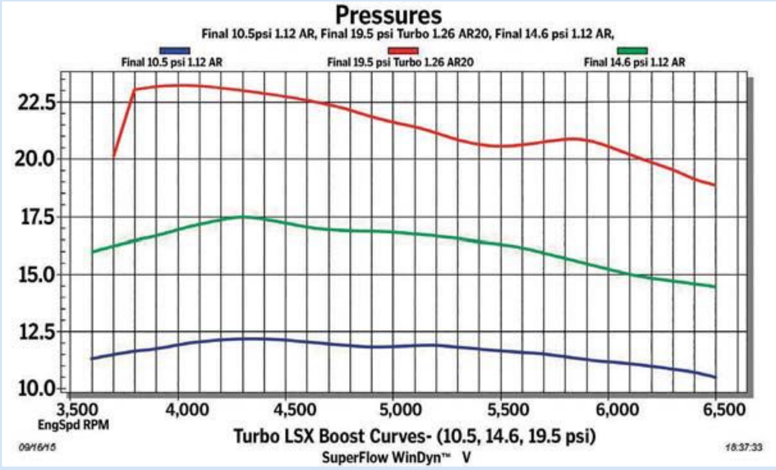
SINGLE TURBO LSX: 10.5 VS. 14.6 VS. 19.5 PSI

Raising the boost pressure supplied by the turbo had a positive effect on power. Equipped with the Brian Tooley Racing Stage 3 turbo cam and Holley Hi Ram intake, the turbocharged LSX produced 836 hp and 760 lb-ft of torque at 10.5 psi. Stepping up the boost to 14.6 psi resulted in a jump to 951 hp and 891 lb-ft. The final run netted 1,083 hp and 992 lb-ft of torque at a boost pressure of 19.5 (see boost curves). With a consistent boost curve, the peak power number would be even greater, but we were within 100 hp of the flow limit of the single turbo, so what this LSX motor really needed to make more power was a twin-turbo setup.



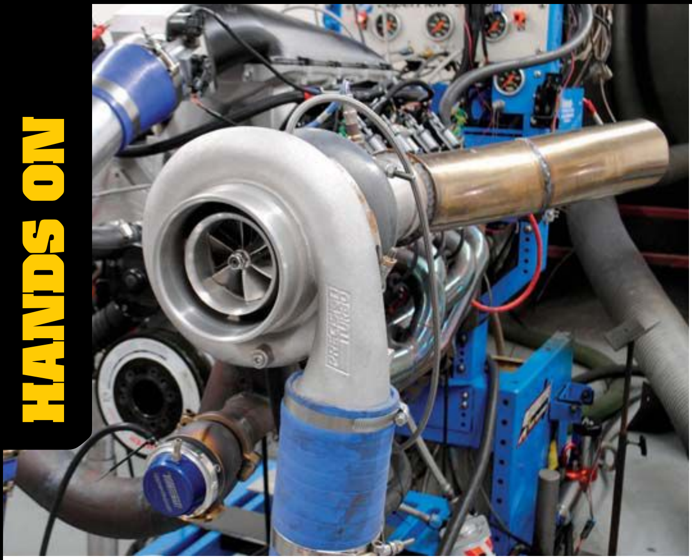
SINGLE TURBO LSX BOOST CURVES: 10.5 VS. 14.6 VS. 19.5 PSI

As evident by the graph, the single-turbo system produced a falling boost curve. The 836hp, 10.5-psi run (bottom) actually started out with 11.3 psi, then rose slightly to 12.2 psi before dropping off to a low of 10.5 psi at the power peak. The subsequent runs at higher boost produced similar curves. The 951hp, 14.5-psi run (middle) started out at 16.0 psi, rose to 17.5 psi, then fell off rapidly to just 14.5 psi. The final 1,082hp (top) run continued the trend, starting at 23.2 psi before dropping down to 18.8 psi. Data logging showed the backpressure to exceed boost pressure by more than 10 psi (and climbing) at the power peak.



Excited that the turbo offered more power potential on paper, we were anxious to apply that theoretical power to the B15 crate motor. To prepare for turbo boost, we replaced the Whipple supercharger and dedicated blower cam with a Holley Hi-Ram intake and Stage 3 turbo cam from Brian Tooley Racing. The single-turbo system consisted of a pair of turbo manifolds (tubular headers) from DNA Motoring combined with a custom Y-pipe designed to accept a T4 flange. Looking for nothing less than four-digit power levels, we selected a 76mm Precision turbocharger. The PT7675 featured a 76mm compressor wheel, GT42-style compressor housing with a

When we last left this LSX crate motor, it was sporting a Whipple supercharger and a new blower cam from Brian Tooley Racing. Cranking up the boost, we eventually made just less than 1,000 hp, but ran into some belt-slippage problems after exceeding 28 psi.



To illustrate that the B15 was ready for boost from any source, we replaced the Whipple supercharger with a single 76mm Precision turbo.

The Whipple supercharger and lower manifold were replaced by a Holley Hi-Ram intake manifold and FAST 102mm throttle-body. We also upgraded the 83-pound Holley injectors with a set of 120-pounders.

Loyal readers will recall that we previously upgraded the factory valvesprings with this dual-spring setup from Brian Tooley Racing. The spring upgrade allowed us to run the dedicated blower cam with the Whipple supercharger.

The spring upgrade also allowed us to safely replace the blower cam (run with the Whipple) with a BTR Stage 3 turbo cam. Ground by Comp Cams, the dedicated turbo grind offers 0.609/0.610-inch lift, 230/235-degree duration, and a more turbo-friendly 114-degree lobe-separation angle.

For turbo use, we installed this Moroso oil pan (pick up and windage tray). Note the bulkhead oil return fitting used with the turbo.

V-band discharge flange, and a 75mm (84 trim) turbine wheel. We started out with the 1.12 A/R exhaust housing, but ultimately switched to the larger 1.28 housing. Boost from the Precision turbo was fed through an air-to-water intercooler from CX Racing and controlled by a pair of Turbo Smart wastegates using its manual controller. The final touches included larger injectors controlled by a Holley Dominator EFI system.

It was obvious right off the bat that the B was begging for boost, as the turbocharged LSX immediately belted out impressive power numbers. Running just 10.5 psi at the power peak, the turbocharged LS produced 836 hp and 760 lb-ft of torque. In a perfect world, the wastegates would maintain a flat boost curve once the motor came up on boost, but our system produced a falling boost curve. The culprit was likely excessive backpressure in the single-turbo system, because the wastegate functions when boost overrides the supplied wastegate spring pressure. Unfortunately, the backpressure applied to the wastegate valve combines with the boost supplied to the diaphragm to prematurely open the wastegate and excessive (or ever-increasing) backpressure makes life difficult for proper boost control. Regardless, the turbo B15 still produced amazing power, with 951 hp coming at 14.6 psi then 1,082 hp at 19.5 psi. After eclipsing the 1,000hp mark, you'd think we would be satisfied, but we had a B15 just begging for more boost. Since the amazing little crate motor shrugged off all the abuse from our single turbo, maybe next time we need to hit this thing with multiple power-adders.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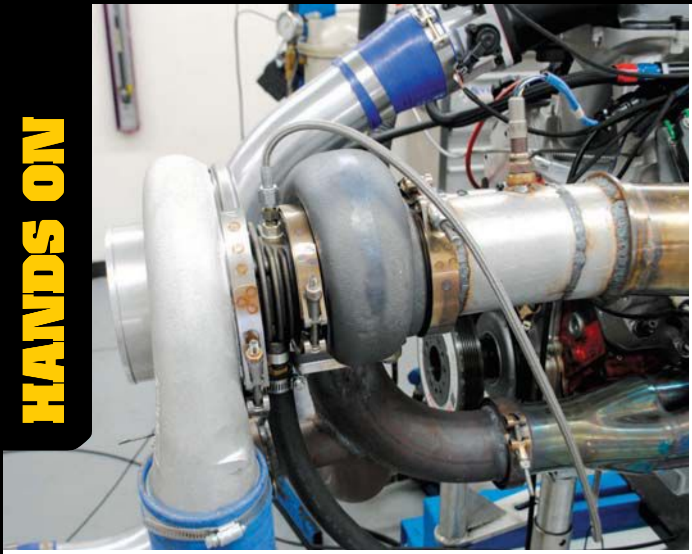
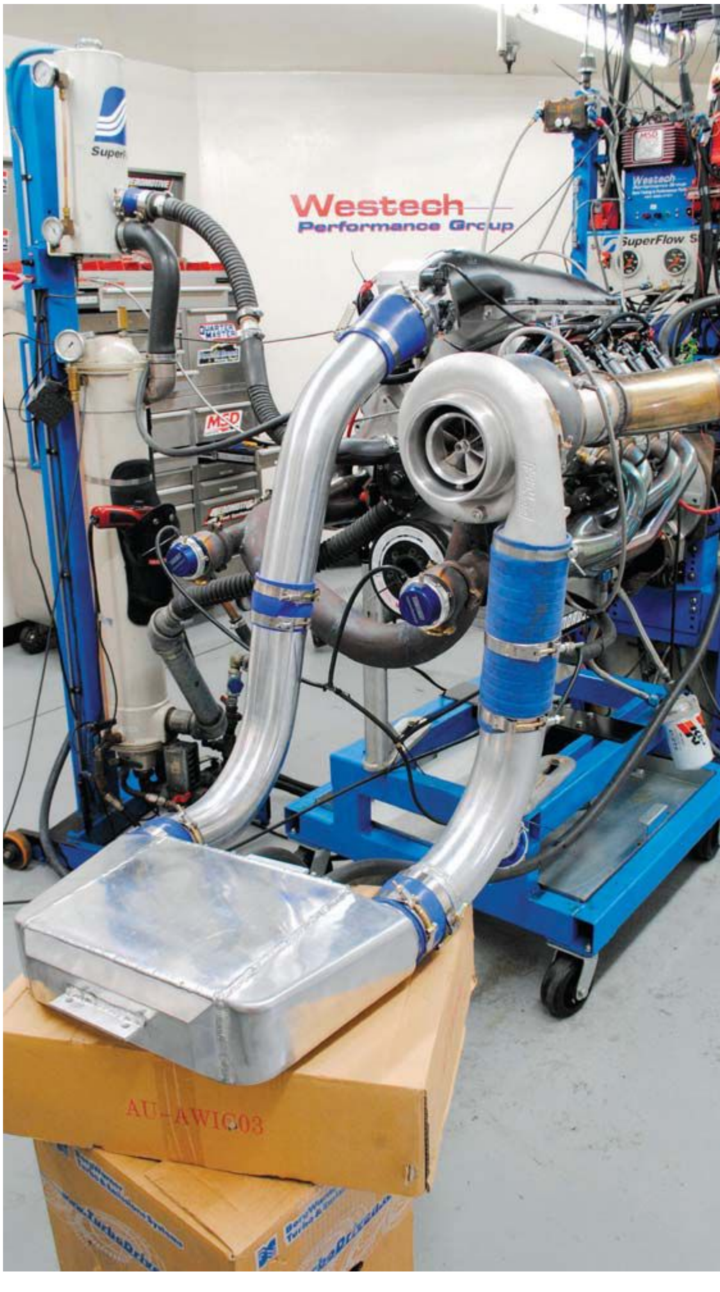


The Precision turbo required both a high-pressure oil feed and low-pressure return back to the pan. The use of V-band clamps facilitated proper orientation of the compressor and turbine housings.

Feeding the turbo was a set of tubular turbo manifolds provided by DNA Motoring. The manifolds featured stainless steel construction and V-band flanges to connect to our custom Y-pipe.

Completing the hot side of the turbo system was a custom Y-pipe that featured V-band connections for the turbo manifolds, a T4 turbo flange, and a pair of wastegate flanges designed to accept the dual 45mm Hypergate wastegates from Turbo Smart. The hot gases exited the turbine housing through a 4.5-inch exhaust equipped with the necessary oxygen-sensor bung for monitoring the air/fuel ratio.



Like the Whipple supercharger, the turbo system featured an air-to-water intercooler. This core from CXRacing maximized airflow with 3.5-inch inlet and outlets. We relied on dyno water for cooling, though additional power was available with ice water as the cooling medium. This intercooler dropped the air-intake temps by more than 140 degrees. The cold side of the turbo system included 3.5-inch aluminum tubing and couplers used to connect the turbo to the intercooler and the intercooler to the throttle-body.

To eliminate compressor surge under high-boost, lift-throttle conditions, we installed a Turbo Smart Race Port blow-off valve.

Tuning was critical on a high-horsepower, turbo LS application, so we relied on this Holley Dominator EFI system to dial in the air/fuel and timing curves.

Concerned about backpressure, we even tried stepping up the A/R of the turbine housing from 1.12 to 1.28 to reduce backpressure and improve exhaust flow. The change netted a 1-psi increase in boost and a 1.25-psi decrease in backpressure. Once we had everything dialed in, we raised the boost using a manual wastegate controller. Running 10.5 psi, the turbo LSX produced 836 hp, which jumped to 951 hp at 14.6 psi. The final run netted 1,083 hp at 19.5 psi, illustrating that regardless of the source, the little B15 crate motor was always begging for boost.

→SOURCES

Chevrolet Performance; Chevrolet.com/Performance
Comp Cams; 901/795-2400; CompCams.com
CXRacing; 626/575-3288; CXRacing.com
DNA Motoring; 626/965-8898; DNAMotoring.com
Holley; 270/782-2900; Holley.com
Lil John's Motorsport Solutions; 888-583-4408; LilJohnsMotorsports.com
Lucas Oil; LucasOil.com
Precision Turbo; 219/996-7832; PrecisionTurbo.net
Turbo Smart; 909/476-2570; TurboSmartUSA.com

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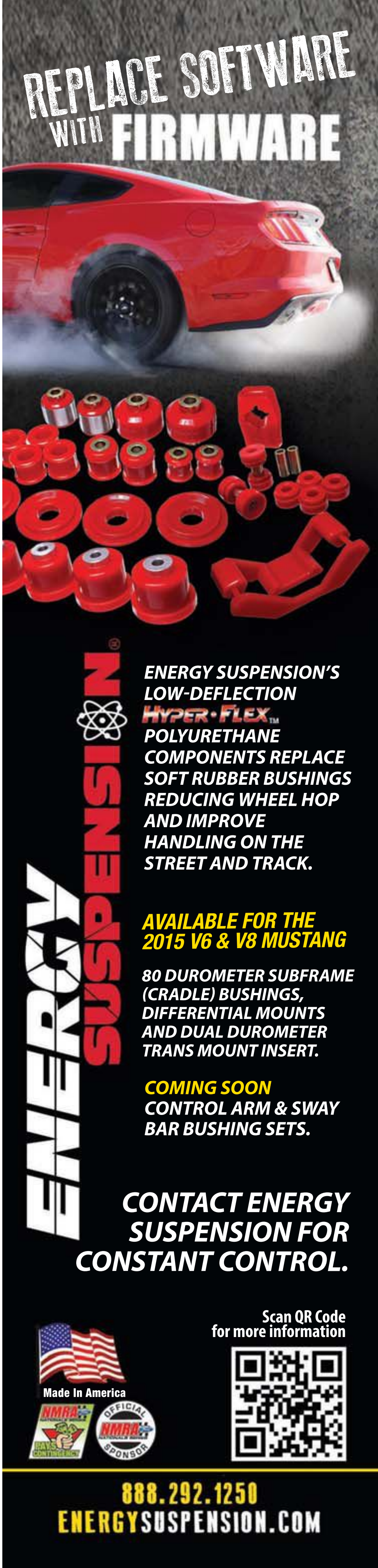

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ASK ANYTHING

Photo: Steve Magnante

RACE INSURANCE UPDATE

Before we dig into this month's mail bag, let's return to the topic of race-car insurance. In a recent Ask Anything, a question regarding the existence of on-track damage insurance for race cars was broached. At the time, the only coverage we could verify was for the *off-track* aspects of a day at the races. You know, stuff like theft of gear, low-speed fender benders in the parking lot, trailer damage, and that kind of stuff. The actual "race car at speed on the racing surface" was excluded entirely from these policies. Kinda defeats the point, huh? But we recently learned about Lockton Affinity Motorsports Insurance (866/582-4957; LocktonMotorsports.com), and it looks like a step in the right direction. We called to learn more and discovered that Lockton offers single- and multi-event coverage that actually applies to damage done to your car on the race surface. But the on-track action must be of the HPDE type—that stands for High Performance Driver Education (school). These are essentially safe-driving and defensive-driving classes where passing is prohibited (or strictly controlled) and lap times are not recorded.

OK, so that eliminates highly competitive, timed, road-race events from coverage, and when we asked about drag racing, perhaps the least dangerous form of racing in terms of potential exterior vehicle damage, the answer was no. Still, Lockton's attitude is promising and may evolve into something more useful for actual racers. We'll bring you more developments as they materialize.

2010 CHALLENGER SRT8 YAWN-BY-WIRE

Greg Heath; via CarCraft@carcraft.com: Ask Anything is the greatest—it's my first stop with each new issue. I read straight through regardless of the subject. It's always interesting, and I've learned a great deal. I'm looking for help with the fly-by-wire throttle on my 2010 Challenger SRT8 with a six-speed transmission. I think it emails someone for permission each time I romp on it. Can you point me toward some likely resources?

Steve Magnante: There is no such thing as a non-worthy question, and thanks for getting the point that these Q&A's don't necessarily have to apply directly to our particular situations to be of use and interest. OK, I know what you're talking about with regard to your

Chally's lazy throttle response. I've spent lots of time at the wheel of 5.7, 6.4, and Hellcat Hemi Challengers recently and came away befuddled by the way each defied my right foot's efforts to make cool sounds at stoplights with the transmission in Neutral and my right foot tapping away in the age-old practice of "throwing revs" (each of them had an automatic).

Lets get this out there right up front: I'm used to old-school "analog" muscle cars with carburetors, accelerator cables, throttle return springs, and no rpm limiter beyond valve float or mechanical failure. No, you never intentionally flat-foot an engine with the transmission in Neutral, but with these older cars, the driver (and an educated right foot) shares a large chunk of the responsibility for engine survival. I have a 512-cube Max Wedge with twin Edelbrock 750s that loves to throw revs against competitors. Plus, I love how the torque rocks the body of the light 1963 Dart it's bolted to.

Getting back to messing with these new Challengers. Though the first half of each throttle stab delivered instant, crisp action as the tach needle zipped from idle to 5,000 rpm, it was the relax mode (second half) that seemed really lazy. The engines slowly stepped back down from high rpm to idle in slow motion, with the supercharged Hellcat taking the most time and actually hovering at 4,000 for a few *seconds* before dropping back down to idle. In the time it took for one cycle, I could have blipped my Max Wedge to 6,000 rpm three times. Any potent analog V8 of any make or size can do similar goofy-fun things, but aboard the Hellcat, onlookers must have thought I was some clueless ding-dong with a stiff right ankle. The loud commotion was like an air-raid siren on bleed down. After a few attempts, I gave up on throwing revs whenever people said, "Ooh, a Hellcat, lets hear it!"

For some context, I subsequently jumped aboard a 2015 Mustang 5.0 and 2016 Camaro SS with the new 455hp, direct-injection 6.2. Both were automatics and, yep, they also defied my aggressive throttle foot with

impressive rpm rises but lame, slow-motion crank speed decelerations. Even stranger, in a 2016 Challenger R/T with the 5.7 Hemi and eight-speed Torqueflite automatic, the engine is restricted to 4,000 rpm if you flat-foot it in Neutral or Park. You can put a bag of cement on the pedal and it'll sit at 4-grand all day. No, you don't want to do dumb things like this on purpose, but it was still a shock to experience.

However, there is a method to this seeming lameness. It's all about tailpipe emissions and the federal watchdogs in charge of minimizing them. One of the dirtiest phases of any engine is the time spent returning from a deep stab of the gas pedal back down to idle. When we throw revs like this, the fuel mixture toggles between full-rich and idle-lean when pedal pressure is released. If you stand behind any pre-emissions muscle car in this situation, the resulting exhaust gases will make your eyes water with loads of unburned hydrocarbons fouling the air.

When the Dodge engineers created the drive-by-wire calibration tables for your SRT8, they had to work within the EPA's strictly monitored tailpipe emissions protocol. To tame the stinky-rich result of throwing revs, they programmed the electronic throttle-body (drive by wire) to close slowly and very much out of synch with gas-pedal motion. Also during this phase, extra air is pumped into the exhaust stream ahead of the catalytic converters to elevate the temperature and cook remaining unburned hydrocarbons. Ignition timing and injector duty cycles are also toggled to help clean up the stink before it exits the twin tips under the trunk. If your 2010 SRT8 is equipped with a six-speed stick, the same functions are at play, albeit with different calibrations to handle the wider range of driver/vehicle interfaces made possible with a clutch pedal. All of this speaks to the growing presence of electronic "nannies" integrated into every new car, including the latest muscle machines. Without them, there is no way we could "have our cake and burn rubber too." Truth be told, the 1986 debut of the EFI-equipped Mustang 5.0 was a monumental turning point. I was among the doubters who mourned the death of the Holley four-barrel-equipped 1985 Mustangs but have since learned to worship computer-controlled Detroit muscle.

So how do we improve on the situation? It's easy. Just go to one of the aftermarket tuners and score a re-programmer to soften the intrusion of "nanny." There are numerous sources for Gen III Hemi tuning systems, with Diablo Sport, Hypertech, and Jet Performance among the better known. These units will improve the crispness of throttle response, though the delayed wind-down may not be fully eliminated since it takes

time for the additional air to burn the stinky stuff clear. And if you're subjected to state emissions testing, be sure the calibrator you choose is legal for road use.

MORE INFO

Diablo Sport; 561/908-0041; DiabloSport.com
Hypertech; 901/382-8888; Hypertech-Inc.com
Jet Performance; 800/535-1161; JetChip.com

EASY RIDER IN A GOAT

Since this is the May issue of **Car Craft**, let's take a moment to remember that May 29 marks the date in 2010 that actor Dennis Hopper passed away. The legend is shown (*above right*) with one of the 2004 Pontiac GTOs used in *The Last Ride*, a 2004 made-for-TV movie he starred in. At the time, the Pontiac Motor Division was very much alive and had just released the Australian Holden Monaro–based GTO here in the U.S. Though gone today, the revived GTO represented a key attitude shift and helped set the stage for the current, rear-wheel-drive muscle-car movement.

I took this picture on May 27, 2004, during *The Last Ride* movie premiere in West Hollywood, California. After the crowd cleared, I spent some time scrutinizing the bright-red movie car. I noticed some unusual features and sleight of hand. Though previewing the optional 2005 dual-scoop hood (visible to the left of Hopper's right elbow), the movie car lacked the production version's red powder-coated disc brake calipers. Out back, I checked the exhaust tips. When the 2004 GTO arrived, the 350hp LS1 exhaled through a true, full-length, dual-exhaust system. It sounded great, too, thanks to many weeks spent by engineers tuning mufflers and resonators to deliver an aggressive note both inside and outside the cabin. The problem was that Pontiac stuck with the Australian Monaro's side-by-side exhaust-tip treatment. Unfortunately, its paired, round tips exited together from the driver side of the rear fascia.

Photo: Steve Magnante

Despite chrome tips, it looked a lot like the glorified single tailpipe used on pre-1985 5.0L Mustangs. It was lame and triggered flashbacks to the Smog Seventies when expensive catalytic converters (one per car, please, demanded the bean counters) forced various absurd 2-into-1-into-2 quasi dual-exhaust systems on the public. Pontiac remedied the situation in 2005 by routing the passenger-side tailpipe above the rear suspension members and out the fascia in classic V8 muscle-car fashion. But since this made-for-TV GTO was built many months ahead of the actual 2005 models, a close look under its tail revealed the passenger-side tailpipe to be a fake! After a foot of inboard length, a steel cap was welded over the end and the illusion was complete. On the driver side, the usual dual pipes were merged into a common outlet. But I wasn't fooled!

I didn't look under the hood, but I'd bet a 5.7L LS was present. After all, if the 2005-spec dual exhaust wasn't available when this car was prepared for movie use, it is doubtful the 2005–2006 6.0L LS2 would be either. Regardless, the "small" 5.7 with its 350 *net* horsepower was certainly just as capable of delivering on-screen action as the 400hp 6.0. Funny thing, I didn't stick around to watch the late-afternoon movie screening. I probably had a date with an extra-cheese pizza. Have you seen the movie? Got a quick review? We'd love to hear it.

ASK ANYTHING— WE'VE GOT SOLUTIONS!

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→CC QUICKIES

Stay tuned for a Dodge 360 Magnum build as we continue our series on Junkyard Gem small-block builds. The Magnum we grabbed displayed the typical cracking between the intake and exhaust valve seats. Not just on one cylinder but all of them. Looks like a new set of heads are in our future.

THIS GUY'S GARAGE

In the parts business, Dave comes across some killer deals on parts and equipment. The toolboxes, parts-storage bins, and giant Ingersoll-Rand air compressor were all picked up at good prices and help make Dave's shop completely self-sufficient.

This 1967 Nova belongs to Dave's wife, Amy. Dave found it for sale on eBay 10 years ago and picked it up for the paltry sum of $3,500. It's powered by a 383 small-block, backed by a TH700-R4 transmission. Dave installed Heidts front and rear suspension, which includes a 9-inch rear axle and 3.73 gears. The Wilwood big-brake kit includes six-piston front calipers, with four-piston calipers gripping the rear rotors. Amy drives the wheels off this car, competing in local autocross and open track events, plus taking it on the *Hot Rod* Power Tour seven times. The Nova was also Amy's inspiration to start ARS Promotions, a video production company that covers motorsports, highlights local car businesses, and features cool cars throughout the Midwest. Check them out at ARSPromotions.com.

Dave bought this 1967 Chevelle SS six years ago. Prior to that, it had been in storage for more than 20 years, so it needed a significant amount of work to get it back on the road. He did all the work in this garage, taking the body off the frame, cleaning and straightening the body and chassis, and painting the car back to its original Nantucket blue. He modernized the driveline by dropping in a 502 crate engine from Chevrolet Performance, backing it up with a Tremec TKO 600 five-speed transmission. Purists will be pleased to hear he saved the car's original 396 and Muncie trans. FAST fuel injection and the Tremec overdrive help the car get nearly 18 mpg on the highway.

The 1968 Camaro Z/28 was Dave's first car. He bought it in 1983 when he was 18. It's also got a 400 small-block with AFR heads. A Muncie four-speed links to a 12-bolt rear. It's no slouch, either—the car runs in the 11s at the track.

DAVE DAYTON / Gurnee, IL

Dave randomly emailed **Car Craft** with a picture of his garage, and his timing couldn't have been better. We had a spot to fill this month, his garage is full of sweet cars, and that's all the persuasion we needed. Dave is an Army veteran who got into the parts-supply business as a civilian. He buys and sells parts for automotive repair and manufacturing companies, and that line of work offers plenty of leads on cool cars and equipment at good prices. He built this 2,165-square-foot garage behind his home in Gurnee, Illinois, being careful to keep the structure within his local zoning ordinances, which mandate that the garage can't be bigger than his house. So to maximize shop space within these limitations, he designed a garage that's literally a few square feet smaller than his house. Who among us wouldn't have done the same?

By John McGann / Photo: Dave Dayton

The 1973 Corvette used to belong to one of Dave's cousins. She had to sell the car recently after owning it since 1977, and Dave wanted to help her out and still keep the car in the family. It's all-original, right down to the 454 big-block, Quadrajet carburetor, and TH400 transmission.

Though it doesn't look too radical, this 1967 Camaro RS runs 10.0 e.t.'s on the motor in the quarter-mile at Great Lakes Dragaway in Union Grove, Wisconsin. GLD is Dave's home track and helps out as a tech official there. The Camaro sports a warmed-over 400-inch small-block with Dart canted-valve cylinder heads, a TH400 with a transbrake, and a four-link rear suspension with a 9-inch. He's owned it for seven years.

Dave and Amy both ride motorcycles, too, so check out Dave's 2003 Victory Vegas and Amy's Honda Shadow 750. Both are lightly modified and serve as perfect getaways for the fleeting good weather in the Midwest.

PROJECT CAR

GEARED TO GO!

Swapping Centersections in a Mopar 8¾ Rearend

By Jason Sands / Photos: Jason Sands

When we last left our "Low Dollar Dart" project, it had run a less-than-stellar 15.09 at 94 mph in the quarter-mile, thanks in part to its mile-high 2.76 gear ratio. Since our goal was quick e.t.'s at the track, one of our first steps was to up the gearing to a numerically higher ratio so we could get off the line a whole lot quicker. Based upon our current 5,500-rpm shift point, we selected 3.55 gears as a compromise between streetability and track performance. Sure 3.91s might be a little quicker at the track, but we weren't willing to live with more than 3,500 rpm at freeway speeds.

WHY DOES GEARING MAKE A CAR FASTER?

The peak power rating of an engine is what virtually everyone uses as a measuring stick of performance, but in drag racing, what actually matters is the average power that the vehicle puts down when going down the track. In our case, we could leave at about 2,200 rpm if we were really leaning on the converter, so the power that actually matters could be measured from 2,200 rpm to our 5,500-rpm shift point. With steeper gears, the vehicle will get into the powerband quicker right off the launch, with a good bump in Second gear also. Toward the top end of the track, the acceleration rate will be about the same, but by then, the steeper gears will have already made quite a bit of difference.

BUYING A CENTERSECTION

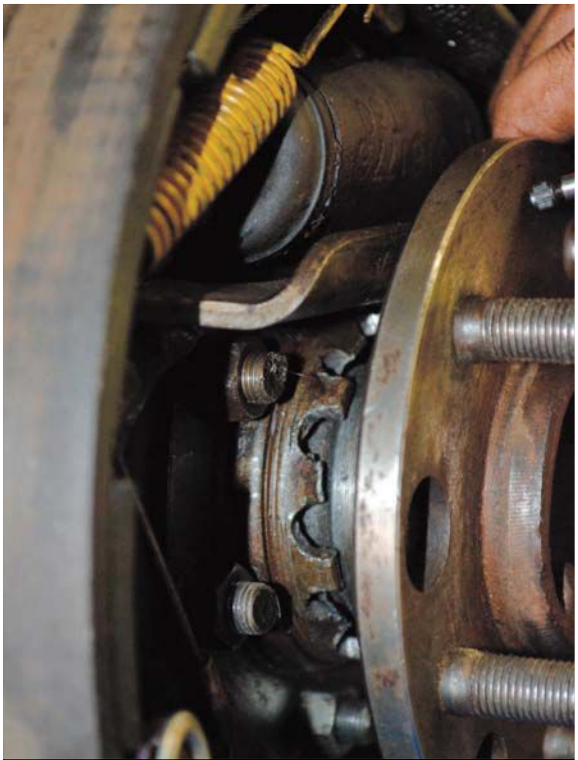
Luckily for us, the 8¾ Mopar that came with our Dart has literally hundreds of used pumpkins floating around the Internet, eBay, Craigslist, and even local papers. With a new centersection coming in at upward of $1,500, it was looking like used was going to be the way to go to keep with

our low-dollar theme. Fortunately for us, after a few months of searching, we were able to score a less-desirable small-pinion 741 case centersection with 3.55 gears and a posi for $300. Since the price was right, we weren't going to quibble over the used gears or questionable posi, and we plunked down the cash for the purchase.

INSTALLATION

Vintage Hot Rod Design and Fabrication in Chico, California, was sympathetic to our cause and offered to help us out. As long as we were OK with a used no-parts warranty (and we were), they were willing to walk us along on installing the new gears in our Dart. As it turns out, it's a good thing they did, as we found a number of errors that a previous shop had made when replacing an axle seal. In good hands, we let mechanic Jody Wilson show us the path to more performance, with an 8¾ centersection swap.

Our first step after we got on a lift at Vintage Hot Rod was to remove the wheel, tires, and brake drums (which should simply pull off). Be aware that some 8¾ rearends have reverse-thread lugs on the passenger side of the vehicle, so you'd actually turn right to loosen them. Our rearend (whatever it was out of) had the standard threads on both sides.



After the brake drums were off, taking the axle retaining nuts (which can be accessed through holes in the axle) and the rotating lock-ring was the next step. Note that there's a metal tang on one of the retaining nuts that holds the lock-ring, which should be kept safe for reinstallation.

After the axle was removed, Jody checked the splines on our used posi to make sure everything lined up. "A lot of people cobble these things together with junk parts and then sell them online or at swap meets," Jody noted. Ours turned out to be OK, so we went ahead with tearing the rest of the rear axle apart.

Next, Jody removed the driver side, just like the passenger side. It was then he noticed that the axle seal was installed improperly and had leaked and washed all the grease off of the axle bearings. Fortunately, there was no damage.

With both axles out, the whole centersection could be unbolted and drained. Either a lot of elbow grease or an impact gun can be helpful at this stage if the bolts have been on there for nearly 50 years.

After saying we had 2.76 gears about 10 times in our first two articles, we discovered we actually had a 2.94:1 ratio. We still anticipated a leap in quarter-mile performance with a step up to 3.55 gears.

We'll spare you the time spent gasket scraping and skip right to the installation of the new centersection gasket. Make sure you get the right one, as most parts store guys will give you a blank look when you tell them you have an 8¾ A-body rear axle."

With the help of fellow employee Paul Bowman, Jody drained and then dropped the centersection. When performing this task, make sure both the rearend and car is secure, as the pumpkin may require some prying and jiggling to remove.

With the new gasket in place, it was time for Bowman to help again, as the new centersection was lifted into place. It had just been removed from another car by its previous owner, so we didn't have to clean it up at all—we just dropped it right in.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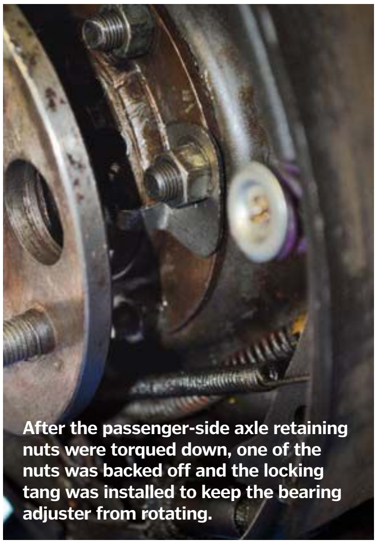
PERFORMANCE TESTING

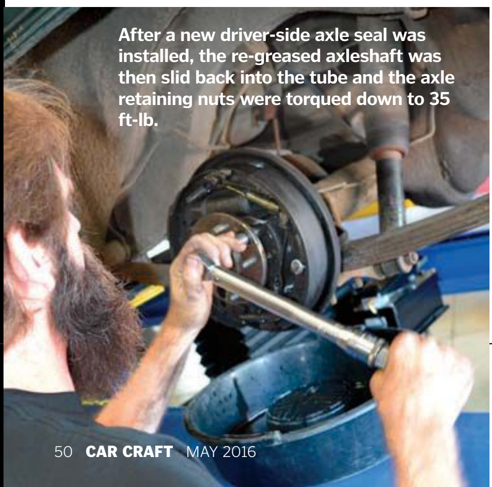
Per Jody's instructions, we went a bit easy on the gearset for the first 50 miles, as he said it was better to be safe, even with used gears. After we couldn't take it anymore, we hooked up the G-tech again and made another run. Virtually every part of the pass was quicker, the 60-foot time dropped from 2.54 to 2.27 seconds, and the 0–60-mph time went from 6.68 seconds to 6.25 seconds. We wish we could give you times past that, but our Dart decided to alert us to the next modification it needs by sputtering and almost dying at about 70 mph. Either our fuel filter is clogged or our stock fuel pump is tapped out. Either way, we expect the gears to be worth a good half second in the quarter-mile, which isn't bad for the same amount of engine power. Speaking of power, we were able to get the '71 on a Superflow dyno at Total Performance Diesel in Santa Rosa, California. Based on our trap speed, we figured around 192 hp at the wheels, and we actually weren't far off—as the car made 197 hp at the tires. What really impressed us, though, was the power curve; the 360 had a diesel-like curve, flattening out at peak power from about 3,500 to 5,000 rpm.

Once the new 3.55 centersection was in place, the nuts to hold the pumpkin in place were torqued down to 45 ft-lb, followed by the U-joint caps to 15 ft-lb.



After the passenger-side axle retaining nuts were torqued down, one of the nuts was backed off and the locking tang was installed to keep the bearing adjuster from rotating.

Jody had indicated that now would be a good time to re-grease the axle bearings, as they're a press-on design and often filled with decades-old grease. Ours especially needed more grease because of the improperly installed seal that Jody had found earlier.



After a new driver-side axle seal was installed, the re-greased axleshaft was then slid back into the tube and the axle retaining nuts were torqued down to 35 ft-lb.

A dial indicator was the only specialty tool that was needed for the install. The endplay was set by rotating the bearing adjuster until the dial indicator read the recommended 0.08-inch spec.

The final step before we hit the road was to fill the differential with roughly 3 quarts of 80W-90 oil until it ran slightly out of the fill hole. We also added an friction-modifying additive for the limited-slip clutches so it wouldn't chatter around tight turns.

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• Weighs 32 lbs.

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62764
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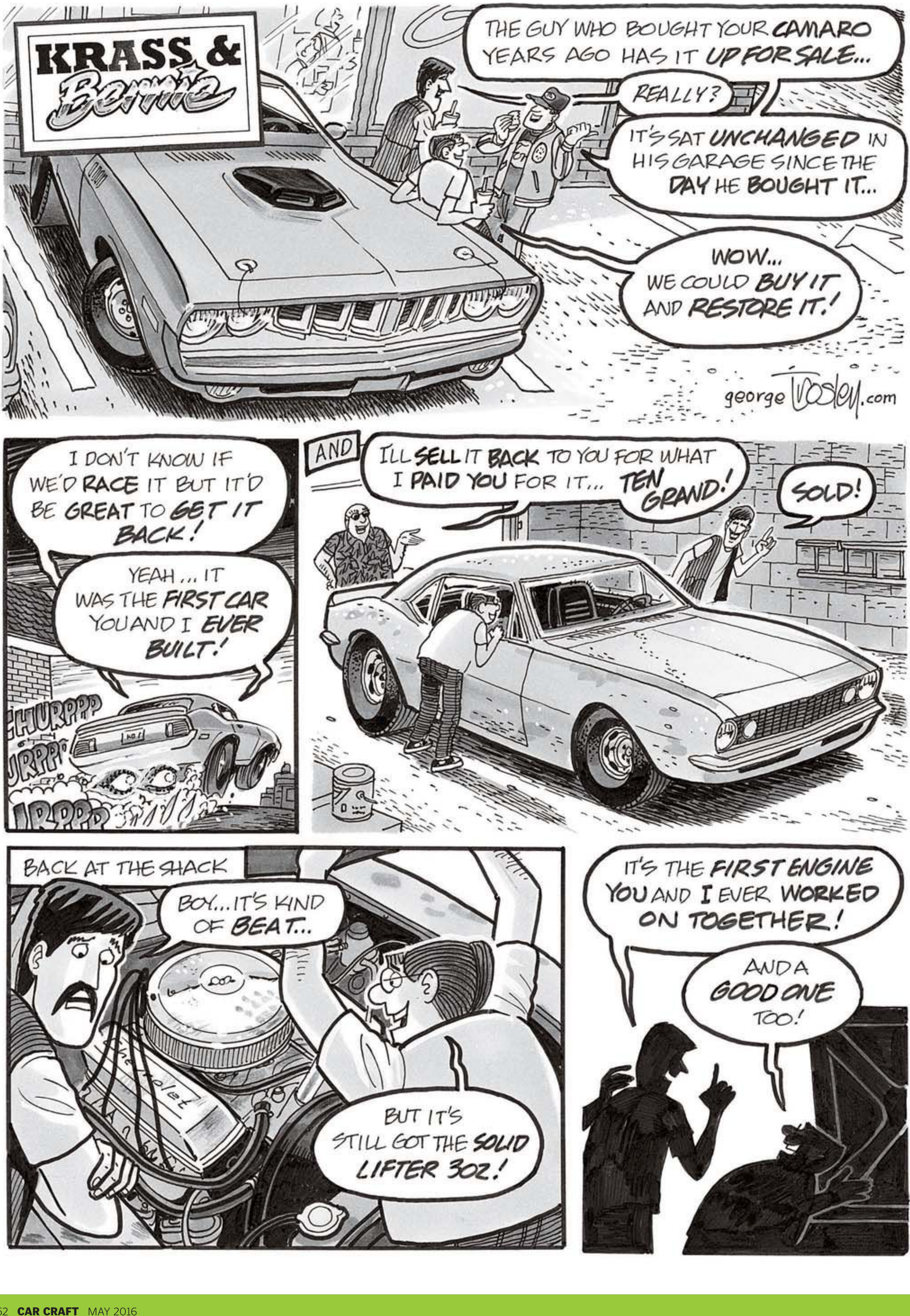
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REALLY?
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YEAH... IT WAS THE FIRST CAR YOU AND I EVER BUILT!
CHURPPP
URPPP
URPPP
AND
I'LL SELL IT BACK TO YOU FOR WHAT I PAID YOU FOR IT... TEN GRAND!
SOLD!
BACK AT THE SHACK
BOY... IT'S KIND OF BEAT...
BUT IT'S STILL GOT THE SOLID LIFTER 302!
IT'S THE FIRST ENGINE YOU AND I EVER WORKED ON TOGETHER!
AND A GOOD ONE TOO!


WE TOOK THE CAMARO TO THE STRIP WHERE YOU CLAIMED YOU HAD RACED MANY TIMES... YOU HAD "RACING EXPERIENCE."
YEAH... I DID HAVE RACING EXPERIENCE... ON THE STREET! BUT HEY... WE BEAT 'EM ALL THAT WEEKEND DIDN'T WE?!!
IT'S THAT NEW K&B CAMARO, FOLKS... TAKING THEIR CLASS AGAIN TODAY!
PRETTY SOON WE WERE TOP DOG EVERY WEEKEND... TROPHIES AND PRIZE MONEY WERE OURS!
AND, OF COURSE, THERE WERE THOSE GREAT AFTER RACE CELEBRATIONS!
THEN SPONSORS STARTED CHASING US...
AND DRAGSTRIPS STARTED TO OFFER US APPEARANCE MONEY!


REMEMBER? WE'D ACTUALLY DRIVE IT TO THE STRIP, RACE THEN DRIVE TO THE NEXT STRIP! WE LIVED IN THAT CAR!
MMMM... WHAT'S THAT SMELL? PIZZA? HEY... GIMMIE A SLICE!
NAHHH... IT'S JUST MY TEE SHIRT...
EAST MAK
KB-1
DZZZZTT DZZZZTT DZZZZTT
DRAG World
DZZZZTT DZZZZTT DZZZZTT
WE WERE EVERYWHERE... EVEN PICKING UP SOME MAGAZINE COVERAGE!
HOT ROD MAGAZINE
AND THEN THAT DUDE WALKED UP AND OFFERED US REALLY BIG BUCKS FOR THE CAR... BIG BUCKS FOR THOSE TIMES.
I'LL GIVE YOU TEN GRAND FOR THAT CAMARO!
THAT GAVE US THE MONEY TO GET INTO OUR GARAGE AND START BUILDING CARS TOGETHER!
MAK REALTY FOR RENT
IT'S THE CAR THAT STARTED IT ALL! WE REALLY CAN'T TOUCH IT... TOO MANY VERY HAPPY MEMORIES!
LET'S JUST GO OVER THE ENGINE AND RUNNING GEAR!
SOON AT THE STRIP
THOUGHT YOU GUYS WERE GONNA' RESTORE THE CAMARO...
KB-1
YEE HAA!
NAHHH... IT RESTORED US!
CHURP CHURP CHURP CHURP
End

AERODYNAMIC ANTIQUE

At 30 Years Old, This 1986 Grand Prix 2+2 Can Conquer Modern Muscle at 160+ MPH

By Rocky Rotella / Photos: Rocky Rotella

The 1986 Grand Prix 2+2 is a model that Pontiac enthusiasts tend to overlook. Granted, the 1,118 production vehicles were identically equipped, powered by a rather anemic 305-inch corporate small-block Chevy rated at 150 hp and an automatic transmission, but the car possessed the capability to do something very special, and Chris Bischof of Southlake, Texas, knows exactly what that is.

No stranger to Pontiac's personal luxury car, Chris grew up in Nebraska, where his father, Jon, had a 1979 Grand Prix SJ powered by a 301 four-barrel. "It was a low-mile, late-model, trade-in that my dad found on a dealer lot in Omaha," says Chris, a 49-year-old turbine repair development engineering manager. "While it wasn't fast, it was a very rare car—one of just 233 equipped with a four-speed manual transmission that year."

As Chris reached adulthood, he relocated to Greenville, South Carolina. "In the late-1990s, I owned a 1986 Buick T-type with the turbocharged 3.8L V6," he says. "I belonged to a local Buick club, and a member told me about a clean 1986 Grand Prix 2+2 sitting on a used-car lot. I knew they were quite aerodynamic and thought it would be fun to install a turbocharged Buick drivetrain and compete in high-speed events like the Silver State Classic and Maxton Mile."

Upon closer inspection, Chris found the car was very complete and totally original, despite its rather high mileage at 108,000. "It had been in the Greenville area its entire life and was completely rust-free. I knew it would require extensive modifications to make it competitive at the level I hoped to run, but thought it would be perfect for my plan and bought it for $4,200," he adds.

Jon remained in Omaha, and as a retiree he had the free time required to supervise the build. "My dad immediately

fell in love with the car and was happy to oversee its progress," Chris says. He shipped the Grand Prix to Nebraska, where Jon arranged for now-defunct HP Motorsports to install a complete rollcage, rear-mounted fuel cell, and upgrade the suspension.

The hunt began for a 1989 Turbo Trans Am from which to pirate the drivetrain. "I liked the idea of a turbocharged engine because I could turn up the boost for certain events and dial it back for others. I considered using an '86–'87 Buick drivetrain, but the turbocharged 3.8L V6 in the T/A has some components that make it unique to that application, and I felt it would keep the Grand Prix all Pontiac in a sense," Chris says.

About that same time, Jon began suggesting to Chris that the Grand Prix needed a manual transmission. "My dad had the 1979 four-speed, and his dream car has always been a 1970 Grand Prix SJ equipped with a manual transmission. He looked at this car as a way to realize his dream. "I knew the manual trans wouldn't be compatible with the powerband of the turbocharged 3.8L engine, and that really convinced me to look into other engine options," he says.

With the popularity of the 1978–1987 Monte Carlo, the aftermarket heavily supports the G-body platform, and dropping in a big-block Chevy is very easy. "We spoke to GM Performance Parts at SEMA 1997, and they sold us on a new ZZ502 crate motor," Chris says. "We then added a Richmond six-speed manual transmission, but have since installed a Tremec T56 Magnum six-speed and added close-ratio overdriven gears for Fifth and Sixth to maximize high-speed performance."

Jon had a local body shop scuff the original finish and apply a fresh coat of Code-12 Silver Metallic paint accented by Code-15 Medium Gray Metallic and install a reproduction stripe kit. During the repaint, the front and rear wheelwells were massaged to accommodate wider tires, and hood vents from a mid-1990s Grand Prix GTP were added to extract heat and relieve underhood pressure at speed. "We weren't overly concerned with the quality of the paint job since we were racing it competitively, but it turned out nice and has held up well," Chris adds.

The conversion from production car to racer took about a year to complete. "The weekend it was finished in 1998, we took it on a 1,500-mile road trip to shake it down, and we've been refining it ever since," he says. "The original suspension setup was geared toward autocrossing, and we found that the car was loose at high speeds. We've since tuned the suspension so it's very stable at speeds in excess of 160 mph."

Open-road racing involves picking a speed class where you attempt to maintain a certain average speed over a given course. The car with the closest average speed to the target wins that particular class. Generally, cars cannot dip more than 30 mph below their target speed or exceed a maximum tech speed, which is preset for the course and monitored by radar and speed traps. Either action will result in disqualification. The car is fitted with three GPS units so the navigator can monitor such details as current speed and course mapping relaying that information to the driver.

At such events, Chris drives and Jon navigates. The two have competed in the Sandhills Open Road Challenge in Arnold, Nebraska, where they've won the 115-mph class four times. "It's a tough course with winding country roads and no shoulders where we try to average 115 mph but not exceed 140 mph at any point. Some corners are taken at 80 mph, so we need to accelerate to 130 as quickly as we can to maintain our 115-mph average," Chris explains.

The duo has also taken top honors in the 135-mph and 140-mph classes at two different events in Texas—the latter being the Big Bend race, which consists of two 59-mile legs starting and ending in Fort Stockton, Texas, where speeds can reach 168 mph. "In 2012, we won the 140-mph class running 140.002 mph, beating a number of high-end sports cars. The race was so close that the top-six finishers in the class were within 0.5 seconds of each other. Our Pontiac finished fourth overall out of 155 total cars in the event," Chris says.

Of his Grand Prix 2+2 in such events, Chris says it's very capable. "We have lots of fun racing, and its aerodynamics are excellent. We've done a lot to make it handle stably and predictably at high speeds, and it's completely solid at 170 mph, even in a crosswind. There is zero front-end lift and we've verified that with pictures taken through the speed traps."

When asked what he loves best about his Grand Prix, Chris replies, "Open-road racing has traditionally been dominated by late-model sports car such as Corvettes, Vipers, and Porches. It's a thrill to compete against them with our antique Pontiac and win." With the low-resistance front fascia, a huge, heavily sloped rear window, and fiberglass decklid with integral spoiler part of Pontiac's wind-tunnel-bred 2+2 package for 1986, the fact that no major body modifications were required to make this 30-year-old car stable at the speeds Chris runs is a testament to the designers' efforts. Now who says Pontiac didn't build excitement during the 1980s?

TECH NOTES

Who: Chris Bischof
What: 1986 Pontiac Grand Prix 2+2
Where: Southlake, TX
Engine: The original small-block 305 was replaced by a ZZ502 from Chevrolet Performance rated at 502 hp at 5,200 rpm and 567 lb-ft of torque at 4,000 rpm. The aluminum oval-port heads were removed in 2012 and pocket ported to increase airflow, and the original 2.25/1.88-inch stainless steel valves were replaced by new Ferrea valves in the same sizes. Comp Cams beehive valvesprings were added to better control the valve action provided by the factory-installed hydraulic roller camshaft featuring 224/234 degrees of 0.050-inch duration and 0.527/0.544-inch lift with 1.7:1 ratio roller rocker arms. Combustion chamber volume remains at 110 cc, which yields a compression ratio of 9.6:1. An 850-cfm Holley carburetor with mechanical secondaries resides atop the original cast-aluminum, dual-plane intake manifold.
Exhaust: Hooker Super Comp tubular headers route spent gases through 2-inch-diameter primary tubes and 3.5-inch collectors. The custom-bent, dual-exhaust system includes 3-inch head pipes, Dynomax UltraFlow mufflers, and Torque Tech mandrel-bent tailpipes.
Transmission: A Tremec T56 Magnum now resides where the original four-speed automatic was. The six-speed manual is bolted to the ZZ502 using a Quicktime blow-proof bellhousing, and power is channeled through a Chevrolet Performance flywheel and 11-inch clutch disc and pressure-plate assembly. A Hurst shifter provides precise upshifts while rowing through the gears toward 170 mph. Chris added an electric pump that circulates the transmission fluid through a cooler for added protection during high-speed competition.
Rear End: The differential is a modified Ford 9-inch from a 1979 Lincoln Versailles complete with an Eaton Detroit Locker differential, Currie axleshafts, and a 3.25:1 gearset.
Suspension: Roll control is handled by a tubular 36mm-diameter front sway bar pirated from a third-gen Firebird, while Chris retained the Grand Prix's original high-effort 12.7:1 ratio power-steering box. Heavy-duty coil springs from Moog and adjustable shock absorbers from VariShock are used front and rear. Adjustable control arms, a 1-inch-diameter Pro Touring sway bar from Spohn, and a Watts link from Fays 2 are used out back.
Brakes: To safely haul the G-body down from triple-digit speed, the stock spindles were modified to accept 12-inch-diameter rotors and dual-piston calipers from Baer Brakes. Rear braking consists of an 11-inch rear disc assembly from a Ford Explorer.
Wheels/Tires: The original 15x7-inch Rally IIs were replaced with 16x8-inch, cast-aluminum, cross-lace wheels from a late-1980s Trans Am GTA and 255/ZR50/16 BFGoodrich G-Force Comp 2 tires at all four corners.
Fuel System: A high-volume Aeromotive electric fuel pump provides the Holley carburetor with a steady supply of 92-octane pump fuel that's regulated to 10 psi. To reduce fuel temperature, a return line routes excessive volume back to the 22-gallon fuel cell that's mounted in the trunk.
Interior: The Grand Prix's original leather-wrapped steering wheel remains. Within the factory dashpad and residing in the pods where the originals were found are a GPS speedometer by Revolution Gauges and an Auto Meter tachometer. Cobra race seats covered in the original ripple-cloth Medium Gray interior fabric complete with five-point R.J.S. racing harnesses provide the front passengers with safety and comfort. A full rollcage with removable door bars improves body rigidity and protects the occupants during competition, but makes rear-seat access impossible. The original center console was removed to accommodate the floor-mounted Hurst shifter and safety equipment controls. A fire-suppression system has also been added.

By J. Joshua Placa / Illustrations: George Trosley

THE FINE AND PLEASANT MISERY OF HOME AUTO REPAIR

The persnickety manifold bolt had been fighting me forever, but all the blood on my knuckles was mine. I drizzled Liquid Wrench on it, tapped it, drizzled, tapped, cursed, spit on it, and pleaded with whatever immovable forces that kept that bolt from giving up. Mindful of not making the rookie mistake of stripping said petulant bolt, I recalled my dad's brilliant backyard innovation of attaching a vice grip onto the end of wrench for added leverage, Finally, the sweet sound of a thread breaking free of rust signaled happy victory. Then disaster struck.

I deftly slid the bolt out, ever so careful to not let it fall out of my grasp and tumble into the engine bay, from which we all know there is seldom a safe return. Then from my outstretched fingertips, the slightest of slips—*ding, ping, cling*—down into the abyss it went. It was a sickening sound, another bolt had come to an ignominious end, lying dead somewhere in an oily crevasse, or left for frozen in the snow below.

Yes, snow. We had neither garage, nor carport, or even a proper driveway—just steel, rubber, and glass above (dirt below). Not hardpack nor pebble, just deep, loamy dirt, the kind that sinks you down to the tops of your ankles when it rains and swallows up small engine parts, with a particular appetite for nuts and bolts, and the occasional, irreplaceable spring.

The search for the wayward bolt begins. Poking around with a flashlight and a blind finger, then in later years, a retractable metal stick with a magnetic tip. If we had discovered this invention sooner, it would have saved me from a lot of mud diving, or in this case, plowing through ice-crusted snow. Of course, the bolt could not be found in any civilized place. Its location fell to one of my designated jobs: chief dirt crawler. So under the car I went, on my belly, pushing snow out of the way with my face, looking for an invisible object. Since my dear Dad didn't mind me spending eternity searching for a lost washer or other puny piece, I thought they must have been priceless gems, surely something we would have to order from a faraway factory at enormous and frivolous expense. I was 11 and already well down the road of learning things the hard way.

And so was life on Long Island during the Johnson Administration, LBJ not Andrew. My father was long on practical genius and creative ingenuity, but short in the pockets. Today, he would have a blog—part entertainment, part automotive advice, part how to stretch a shrewd dollar. Integral to his oily economics was a tidy labor-to-time-management ratio, plus no investment in work conditions—in other words, me. Tougher than postmen, we would change brakes in the pouring rain, the car on wooden blocks groaning like a ship in a storm. Carbs were tweaked in the freezing dead of night, fan belts and radiator hoses replaced in sweltering summer, and balding tires changed in the waterlogged bog that became our driveway after a thunderstorm. It's not that we especially chose to work in those conditions, it's more like this was our habitat, taunting us every time one of the jalopies needed help.

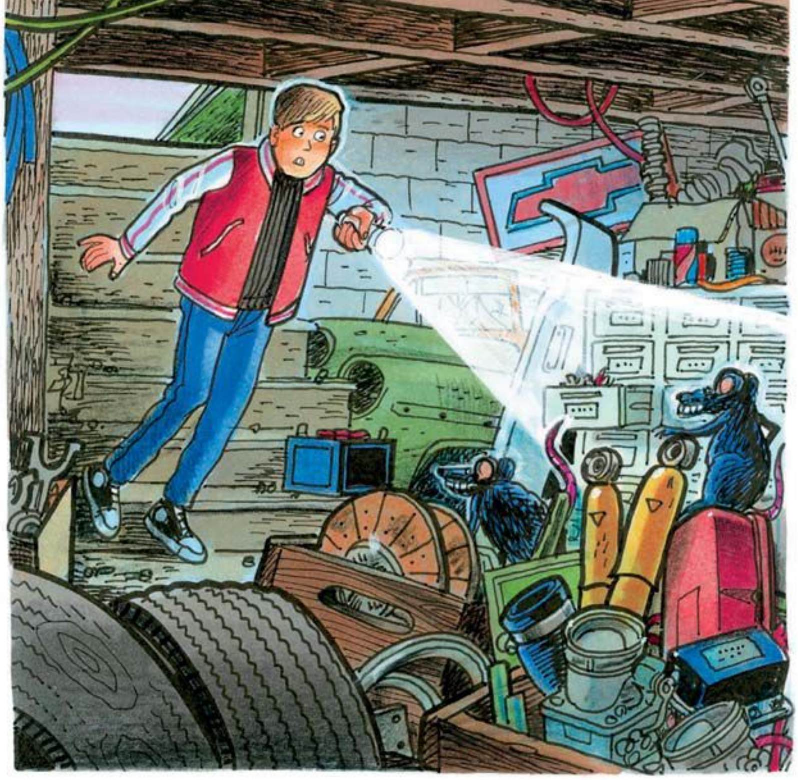
My job was to dismantle everything. This was, of course, long before smartphones and tablets and most anything else that could take pictures of the disassembly, not that we probably would have used any of it anyway. How Dad put anything back together after I was done with it was simply applied magic. Sometimes, fixes became surprisingly eventful as transmissions dropped on bellies, cars tipped off their blocks, engines broke free of their homemade block and tackle, carburetors caught fire, or hands, arms, and feet got stuck in places I didn't know cars had. But before right and proper repairs and reassembly could be made, I was tasked to find the runaway springs and washers, nuts and bolts, and nearly anything else that could squeeze passed pinched fingers and into the land of lost parts.

I don't recall if I ever found anything once it hit the dirt, as if swallowed by another dimension, falling out of the sky and plunking into the palm of a parallel Dad from another universe of broken jalopies. It wasn't until I was a young man living on my own did I realize that almost all of the disappeared could easily be replaced by a trip or two to the local hardware or auto-parts store, usually for change of a dollar. But that's just not the way we did things.

As the official and only go-fer, my professional apprenticeship was largely limited to the musty subterranean confines of the creepy space under our house. The cellar was our sacred tomb to discarded parts from makes and models both familiar and queer. Water pumps and air filters and pistons, crankpins, oil pans, valve covers, fans, hoses, clamps, radiator cores, generators, and every imaginable fastener lay dead or dying in the dark, rusted recesses of the cavern of cannibalized cars. Was this the stuff of crazy tinkerers, ingenious inventors, and wrenchy madmen? Was Frankenstein going to stumble down those cement stairs looking for new bolts? Maybe.

Dad didn't fit the hoarder profile; I did, but that's another story. He was just entering the job market when the Great Depression turned off the world, so he saw value where others didn't. That sense paid off more often than not, but not without cost. Not being "wasteful" had to be paid in time and effort, but he didn't seem to mind, especially if the time was mine.

So I was sent off to the mysterious chamber of mechanical bits from an early age, when my imagination and my mission would sometimes meld. Dad sometimes wondered what I was



doing down there in the basement for so long, fiddling and sifting through steel drawers looking for the right clamp, or eyeballing screws to match the correct thread. Minutes would stand motionless as I saw plugs and pulleys and levers as more than what they were. I thought he would be pleased I was seeing junk's unemancipated potential—that I was becoming one of him. He wasn't, but he did listen to my idea of hooking up all our old generators and batteries to create a working ray gun.

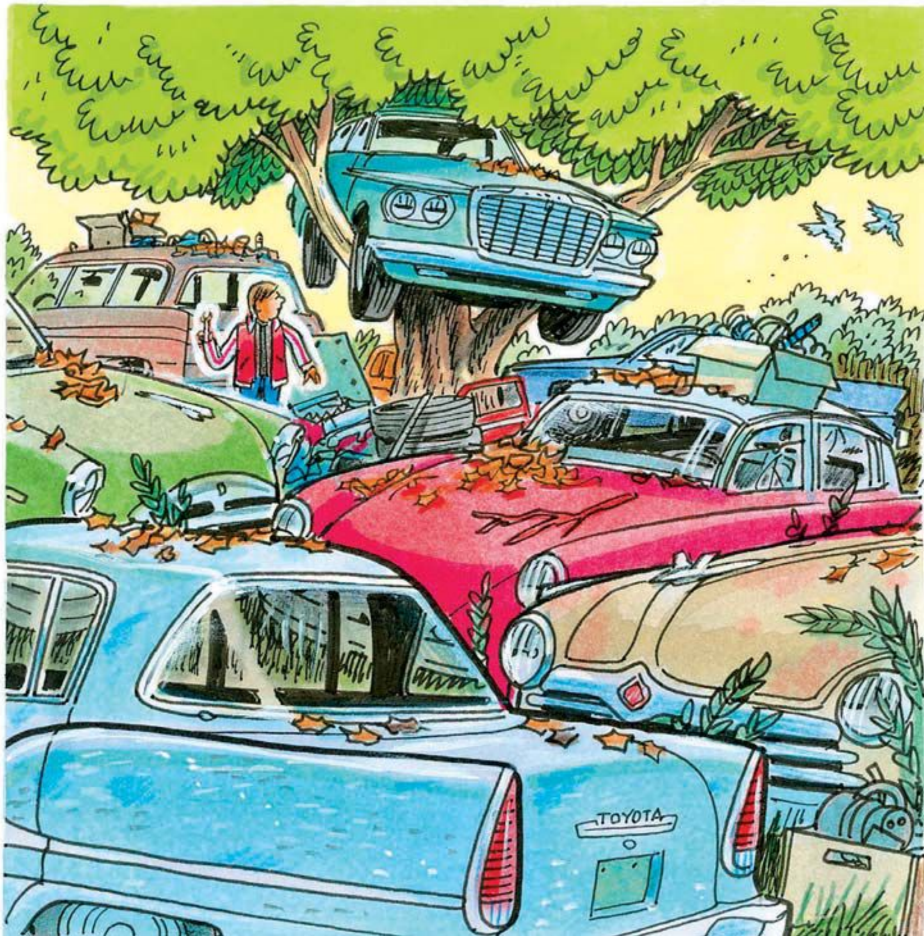
There was no natural order to the spares, just parts Dad thought would somehow come in handy in whole or part someday. He usually was right. It was an unnatural collection of graveyard things—pieces of Oldsmobile, bits of Packard, Buick, Studebaker, Rambler, a couple of Chevys, maybe a Hudson or two, mostly a kind of "what's that?" of extinct models. One Plymouth Valiant was even hung up in a tree. It was either yard art or a parts car, depending on which neighbor he was talking to. Imports would also find their way to our driveway. Uncommon makes like Hillman, a particularly Spartan and homely little car I now think is quite cute, and the plush and exotic Citroen, with its hydraulic suspension and oddball engine works. Add to the mix an elderly Fiat and an early 1960s Toyota, which looked like an ugly, little lunchbox. I watched Dad drive them all in, albeit sometimes towed by strap and nerve, hitched to another one of our spit-and-glue specials.

I hated them all and wish I had most of them back.

My dad had an uncanny, almost godlike, ability to bargain. I would watch it all unfold, incredulously. His standard budget: $100. Maybe it had something to do with rare or wretched cars, out of production and undesirable. Or just confounding, like mid-century Citroens that required a Rube Goldberg–like pull and push of levers and buttons and out-of-sight controls before the ignition sequence could commence. I sometimes saw my father explaining to owners how to use their own cars. It was this preternatural understanding of things that internally combust that gave him an edge.

Then the fun began. He would cite all he found broken and perilous with the car, chipping at the price, wearing down the owner to the inevitable moment he practically begged Dad to take the thing off his hands. "I think I can give you, let's see, I think she's worth maybe a hundred bucks," said Dad to the guy asking $600 for his 1954 Chevy Coupe. "Yes, sir, I'll need to put a lot into it, do all the repairs myself." Looks like rain.

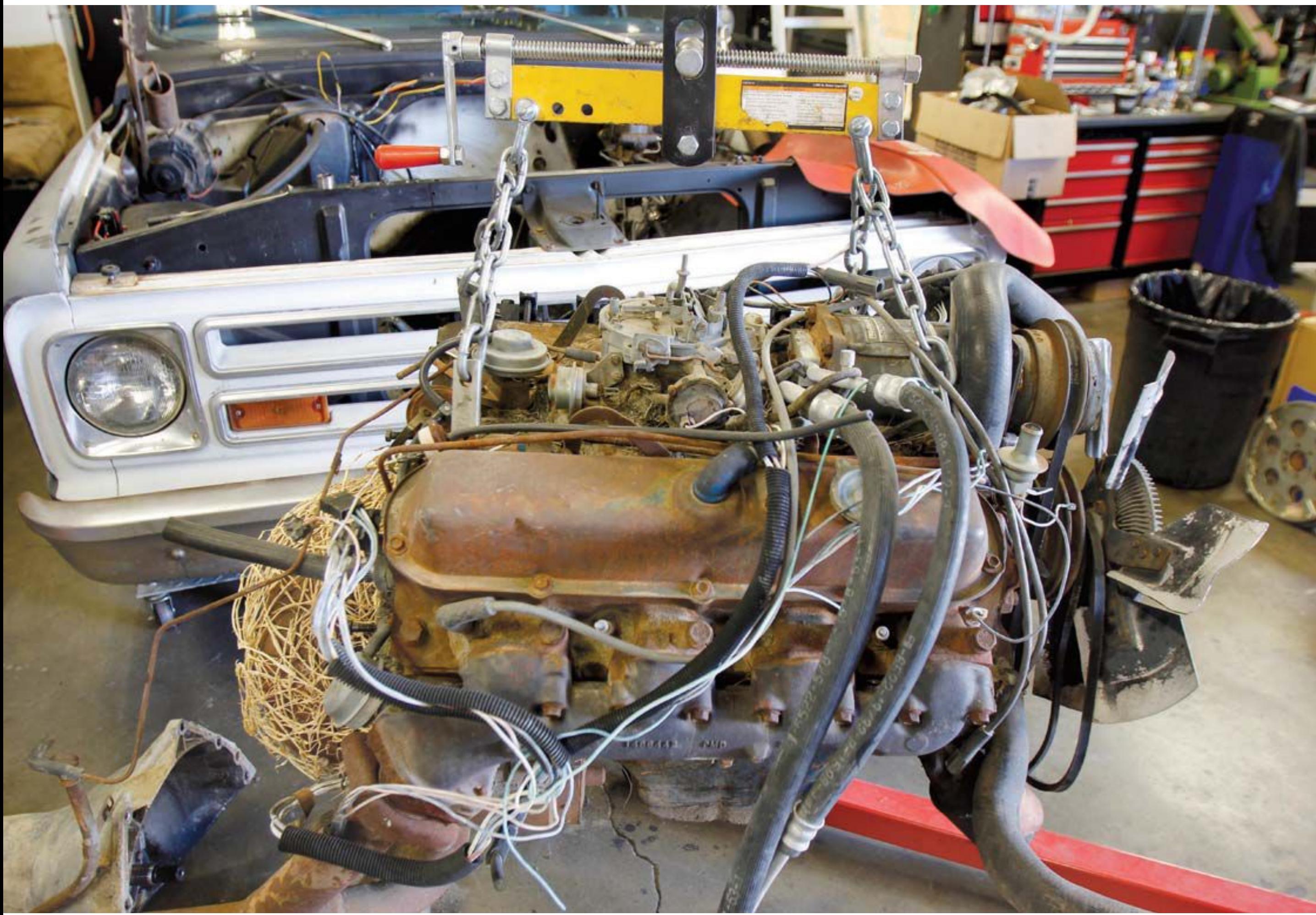
All those old, beautiful, dreadful cars are long gone now, and so is Dad. But the smell of oil and gasoline always takes me back to that driveway, wishing I could have found just one more dirty nut or washer for the old man. I still have Dad's old voltmeter, even though it doesn't work anymore, and his wooden toolbox, which almost never had the right tool for the job. They remind me of him, and how some grit, a little know-how, and a lot of imagination can help us overcome almost anything.



JUNKYARD BUILDER

When Size Does Matter

By John McGann / Photos: John McGann



Yes, that's a rat's nest covering the torque converter.

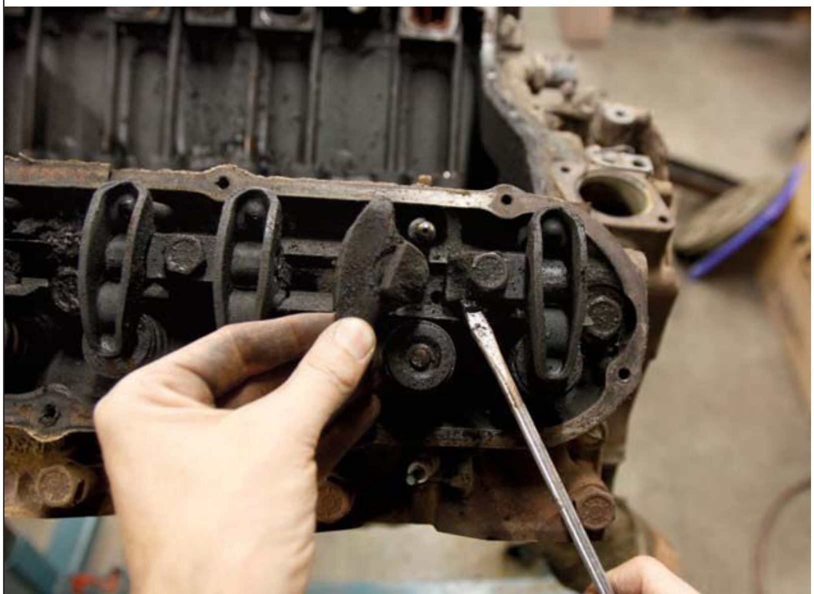
With their 5-inch bore spacing, Cadillac's 472- and 500ci engines were the largest-displacement, domestically produced gasoline engines at the time of their production, which spanned the 1968 to 1976 model years. That record held true until 2002 when Dodge bumped the displacement of the Viper's V10 up to 8.3L, or 506 ci. Unfortunately, these big engines went into production just as the federal government's demands for tightening emissions went into effect, forcing the manufacturers' Band-Aid approach to meeting them. During the first half of its production, the 472 and 500 had a 10.25:1 compression ratio, but around 1971, compression plummeted to 8.5 or even 8.25:1. Power levels took a dive as well. Where once the mighty 10.25:1 engines made 400 hp and 500 lb-ft of torque, the lower-compression engines struggled to make 300 hp. To be fair, it's a bit difficult to judge those numbers, because the switch from gross to net horsepower ratings occurred at this time as well. All you really need to know is these engines make torque—and lots of it. They make enough torque to make some diesel guys jealous, and they do it at low engine speeds—just like a diesel.

In spite of this, it's reasonable to wonder why we'd bother building a 40-year-old engine at this point. The answer lies in the fact that we see at least one 472/500 engine *every* time we go to the junkyards. The engines are still available, they were made with good material, and there is a surprising amount of performance parts available for this platform, so as long as they weren't abused, there is potential to make an impressive amount of power with one. After years of lurking, we decided to dive headlong into the world of these interesting engines and see what we can make of it.

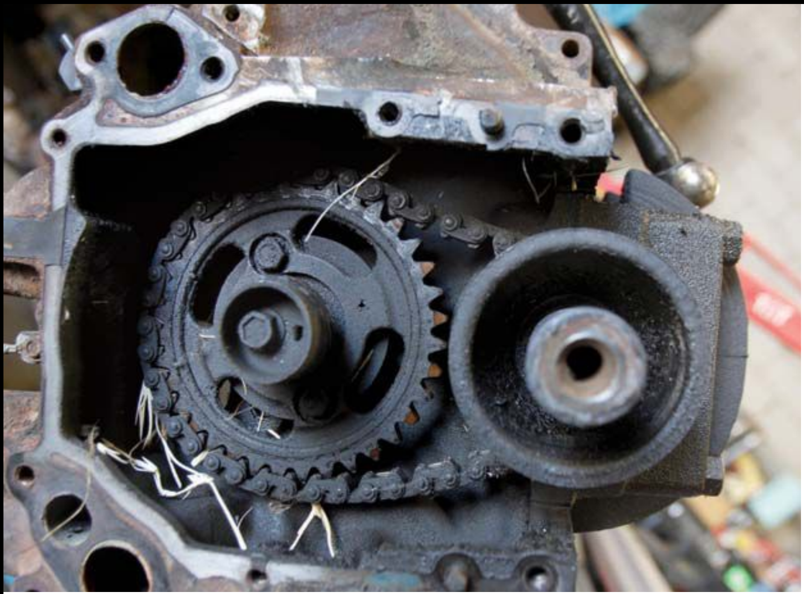
In true **Car Craft** form, we got one of the crustiest examples possible to start with. This is a 500 from possibly a 1975 or 1976 Fleetwood or DeVille we got from Ron's Automotive and Towing in Palm Desert, California. Based on the amount of dust and sand buildup, it's obvious this engine had been liberated from its parent car's engine bay years, if not decades, ago. It was surprisingly complete and included all the accessories (minus the alternator bracket), manifolds, Quadrajet carburetor, and a TH400 transmission.

Engine-block casting numbers don't necessarily tell you if you're looking at 472 or 500, but the cylinder-head casting numbers will at least indicate whether you've got a high- or low-compression engine.

We fully documented the disassembly, noting the variety of fasteners used throughout the engine. For example, the water-pump bolts are at least three different lengths and diameters. Though much larger in exterior dimensions than a small-block Chevy, several trustworthy sources say a Caddy 500 weighs just 60 pounds more than the venerable Mouse motor (we're assuming that means a SBC with cast-iron heads). The block is a lot stronger, too. Caddy Specialist Chris Wisneski from The Cad Company in Albuquerque, New Mexico, says the high-nickel block is a similar alloy to what's used to make a Detroit Diesel engine block. "It's called Arma-Steel and has almost enough nickel to be considered stainless steel," he says.

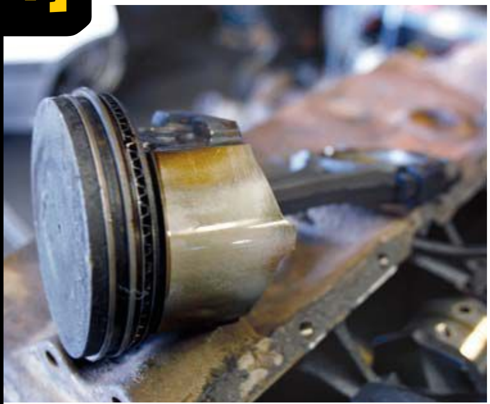


Left: As we got closer to the internals of our engine, we were alarmed to find a broken rocker-arm stand. For as robust as the rest of the engine is, the entire valvetrain is a weak link, with spindly rocker arms, tall and too-thin pushrods, and narrow-diameter valvesprings with so little tension that they go into valve float at about 4,000 rpm.

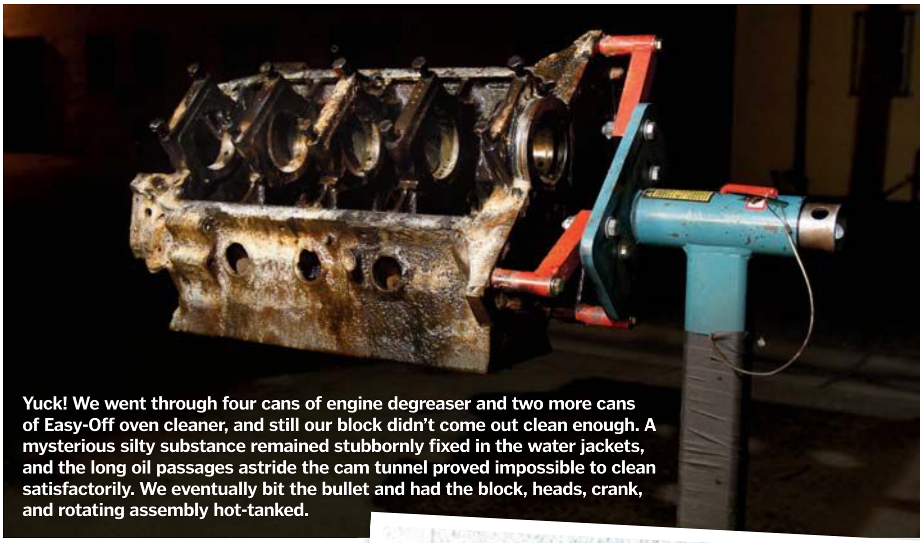


The stock timing set is also questionable. Note the excessive slack in the chain, with the engine rotated on its side. The nylon cam gear has no place in a performance build. That's an oil slinger in front of the crank gear.

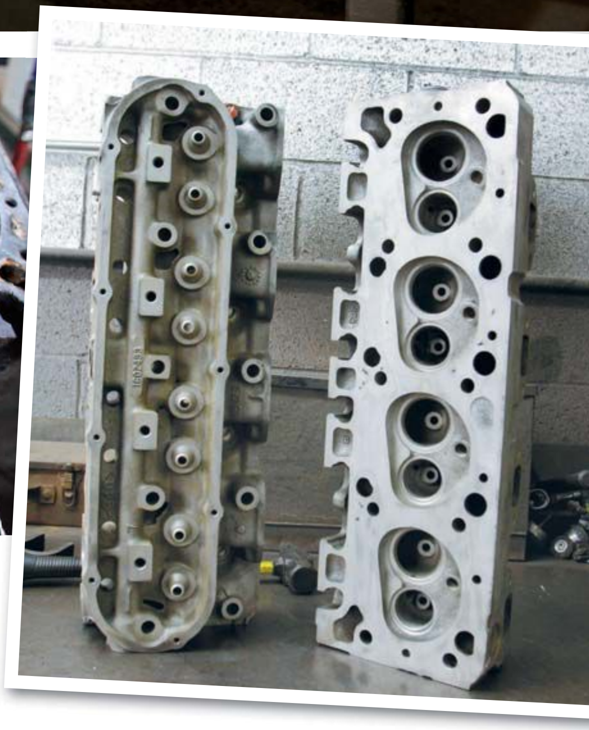
In spite of the excessive amount of sludge and oil residue we encountered during disassembly, our short-block was in good shape and still retained the stock bore size of 4.300-inch.



Likewise, the pistons were in good shape, too, with very little wear on the skirt. Note that stock 472 and 500 pistons don't interchange because the compression height is different between the two.



Yuck! We went through four cans of engine degreaser and two more cans of Easy-Off oven cleaner, and still our block didn't come out clean enough. A mysterious silty substance remained stubbornly fixed in the water jackets, and the long oil passages astride the cam tunnel proved impossible to clean satisfactorily. We eventually bit the bullet and had the block, heads, crank, and rotating assembly hot-tanked.



It's hard to believe these are the same cylinder heads! The baked-on oil and sludge was too difficult to remove at home, but after a round in the hot tank and bead blaster, our engine parts were much cleaner than we would have been able to get them. Thanks to Brian Hafliger at IMM Engines in Indio, California, for giving us a good price. Sometimes it's worth it to pay the professionals.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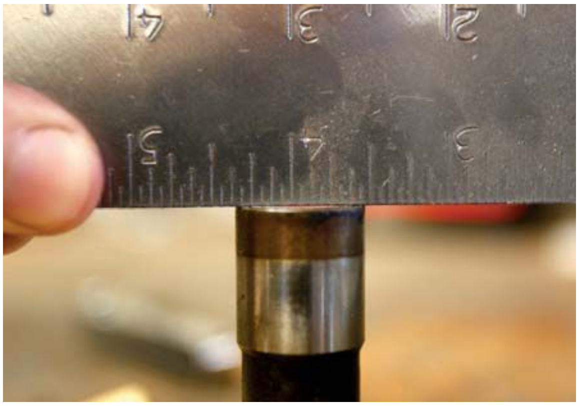
We measured about 0.002-inch taper in the cylinders, which we had Vellios Machine Shop in Lawndale, California, verify. They magnafluxed the block and crank, too. All components are within specs and ready to be reused.



Our cam and lifters didn't fare as well as the rotating assembly. The camshaft shows wear on all but a few of the lobes, and the lifters have worn to a concave surface where they meet the cam. We were able to fit a 0.015-inch feeler gauge on the worst of the cam lobes, relative to the best ones.

We will trash the lifter but reuse the stock cam for the baseline build. After that, we'll take the opportunity to upgrade the valvetrain. At 2.00- and 1.62-inch (intake/exhaust), the stock valves are way too small for the size of the engine. Plus, the inherent weakness of the springs, spindly pushrods, and dodgy rocker-arm system would only limit us to 4,000 rpm. Thumbing though his parts catalog, Hafliger figures 0.100-inch-long Chevy valves would fit and be a cost-effective upgrade, and Cad Company sells a budget-friendly, shaft-mount, rocker-arm system and a spring package that would enable us to build a reliable valvetrain, ensuring tire-shredding torque for years to come. Stay tuned for the next installment.

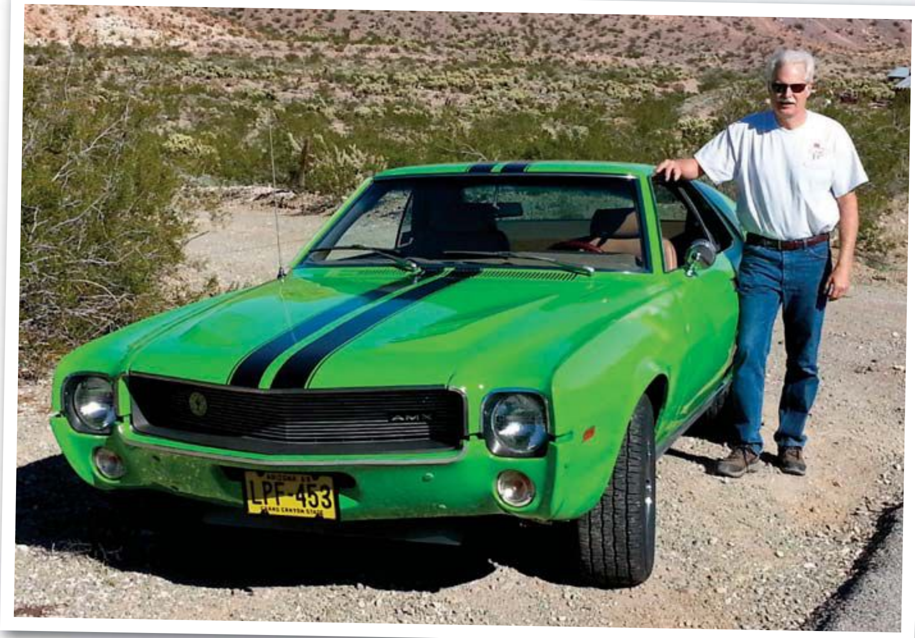
→SOURCES

Cad Company; 505/823-9340; Cad500Parts.com
IMM Engine and Dyno; 760/347-5493; IMMEngines.com
Ron's Automotive and Towing; 760/568-3100
Vellios Machine Shop; 310/643-8540; VelliosMachineShop.com

WTF? (Where's the Fun?)

BIG BAD GREEN

Who: Tom and Sandy Buckley
Where: Scottsdale, AZ
What: 1969 AMC AMX
Why: Tom is the model, Sandy is the photographer. The car is the star, and it has a 390—the original block—coupled to an auto trans. There's also Edelbrock aluminum heads and shorty headers, a Comp 268H cam, Scorpion rockers, and a 625 Carter carb. "Fun car for the road," Tom said. He takes her to regional car shows. The car, too.



THE CARS OF GLASSCOCKS

Who: John Glasscock
What: 1970 Mach 1 and 2005 Mustang GT
Why: These belong to John and his brother. "He used to drive me to kindergarten in his Mach 1 with 351 three-speed manual. Seems like from that moment, I have always loved Mustangs," explained John, who owns the GT. He bought it in 2008 and "added FRRP 'hot rod' cams, 410 gears, and a Paxton Novi 2200 supercharger pushing out 600 hp. My friends call me 'Mustang John' because of all the Mustangs I have had over the years." The Mach 1 has a 1967 Mercury Marauder 410 big-block.

BURNOUT!!

"I bought this 1977 Trash Am for $500. It had been sitting in a grove in Alexandria, Minnesota, for 20 years. Was parked because the original Olds 6.6 motor had a rusted frost plug. I dragged it home and removed the original numbers-matching engine and swapped in a running Pontiac 400 I had and a turbo 350. While I had it apart, I evicted all the mice. Once the engine was in and buttoned up, I had to test out the drivetrain, which I did in my driveway to the dismay of my neighbors—oh well. I have not done any bodywork; I am driving it like it is. I can barrel down gravel roads with T-tops off and not worry about a stone chip. I love my Trash Am rust rod."

—Noel Eichten, via email

CHEVY RESTORED A CORVETTE

What do you get when you have four months, 1,200 hours, 30 techs/craftspeople, and a 1992 Corvette? A four-month, 1,200-hour, 30-person 1992 Corvette restoration. But this is a big deal—it's the one-millionth Corvette, and it had been part of that sinkhole debacle at the National Corvette Museum in 2014, where it and seven other rare Vettes took a dive. Chevy vowed it would restore No. 1,000,000, and this is the second Corvette that Chevy has restored from that incident, the other being an 2009 ZR1 prototype better known as Blue Devil. The museum is going to handle the next car, a 1962. Chevy says the other ones will stay in their as-recovered state and be part of a future display—with a sinkhole theme.

BLOWN-UP PARTS

"1967 Mustang convertible. A good excuse to drop in a new motor…with more horsepower…and power disc brakes…and new suspension…and new wheels…"

—Bob Marinich, via email

→LETTERS

BACON, BACON

Hey—I thought you might like this. J&D's Foods, makers of Bacon Salt, is pleased to announce the launch of Bacon Scented Underwear, the world's first underwear that looks and smells like bacon. Yes, this is real. Marrying the ultimate in comfort and cured meat, J&D's Bacon Scented Underwear represents the gold standard of meat-scented luxury undergarments. Each pair is hand-crafted in the USA to offer the support of briefs, the freedom of boxers, and the smell of breakfast cooking in your pants. You really can have it all. J&D's Bacon Scented Underwear is available exclusively at BaconUnderwear.com for $19.99 per pair and comes in men's and women's styles and sizes.

This is a letter Car Craft got. We have no idea why or how. We like bacon as much as the next person, but we're not printing this as an alternative smell to your underpants. We're printing it as a reminder that we want more letters from you, our readers, not from bacon. What do you like in the magazine? Want more of? Want less of? Send your letters to us at CarCraft@CarCraft.com.

BONUS BURNOUT!!

"Hey, guys, love the magazine, but noticed the Burnout section has been lacking lately! Here's some pictures of my old commuter 1992 Mercedes 190e Sportline with a 2.6 doing some Benz donuts. She wasn't very fast, but she could take a beating. I took her to 6K every day and the only way to spin the tires was donuts and neutral drops, which were a regular occurrence! I have 2003 Cobra, which I've been properly abusing."

—Paul, via email

BONUS BLOWN-UP PARTS

"Here are pictures of my 5.3 LS4 with two destroyed pistons—definitely the worse I've seen."

—Erick Carter, via email

→SEND STUFF TO CAR CRAFT!

We need more pictures of Burnouts, please. While you're at it, send any of your compliments, complaints, random musings, or pet pictures to us. Here's how:

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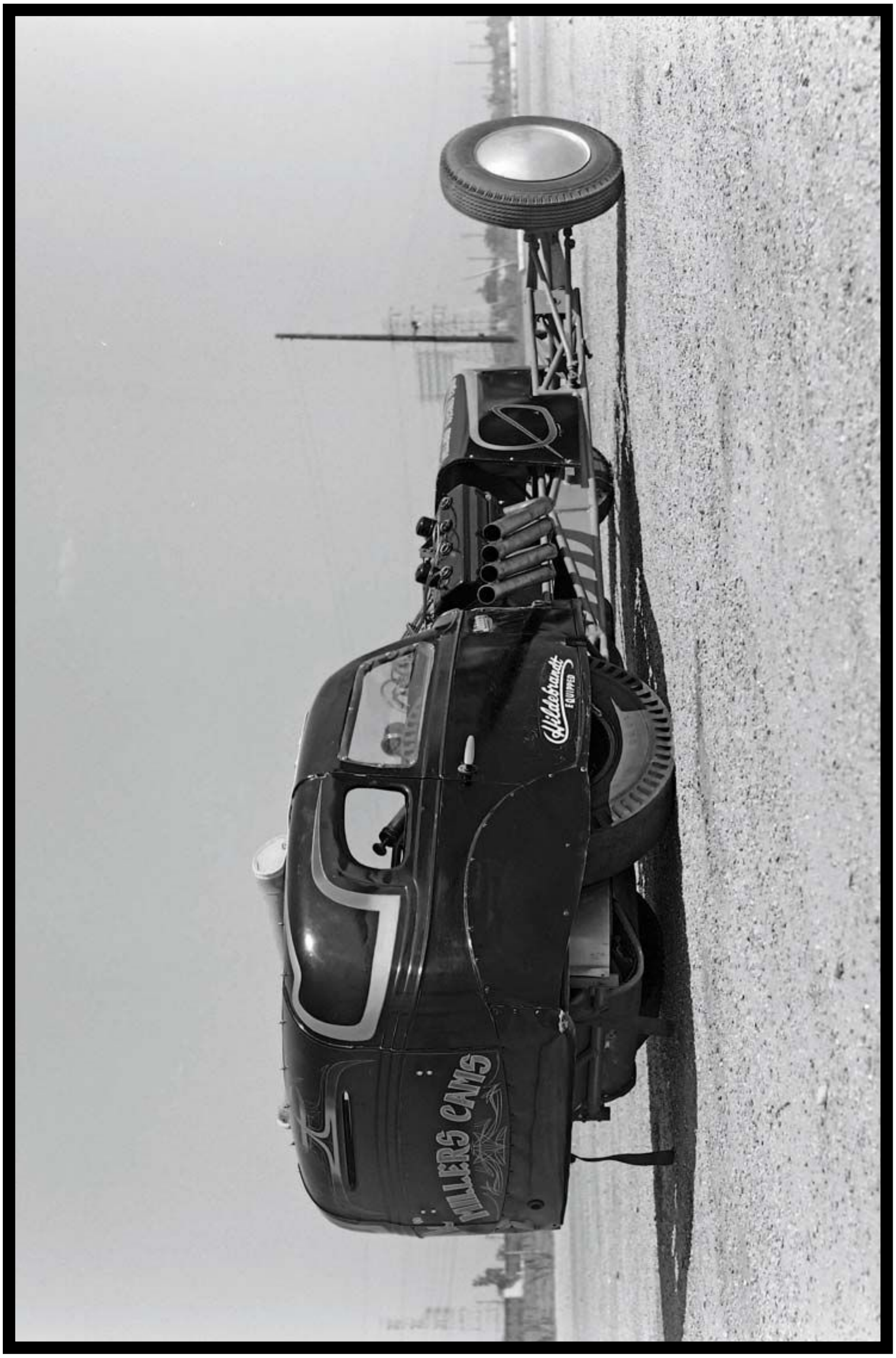
REAR VIEW



BAD BANTAM

Photo opportunities are where you find them. In this case, it happened while *Motor Trend* staffer Wayne Thoms was testing a souped-up Nardi-Vignale Fiat 600 Sport Coupe at Lions Drag Strip in August 1958. Fred Waterworth's "Ak Miller's Racing Cams Special" Comp Coupe was also present, for some shake-down runs in preparation for the upcoming Nationals. Wayne grabbed this beautifully composed shot in the pits. The Ak Special is powered by a fuel-injected 455 Chrysler Hemi. Driver access is via top tonneau. Big pie-crust slicks are tucked neatly inside the chopped 1930 Austin-Bantam bodywork. It's a super-clean build by '58 standards. Waterworth managed an A/Comp class Nats record run before suffering piston problems, clocking 131.18 mph.

By Thomas Voehringer / Photo: Wayne Thoms

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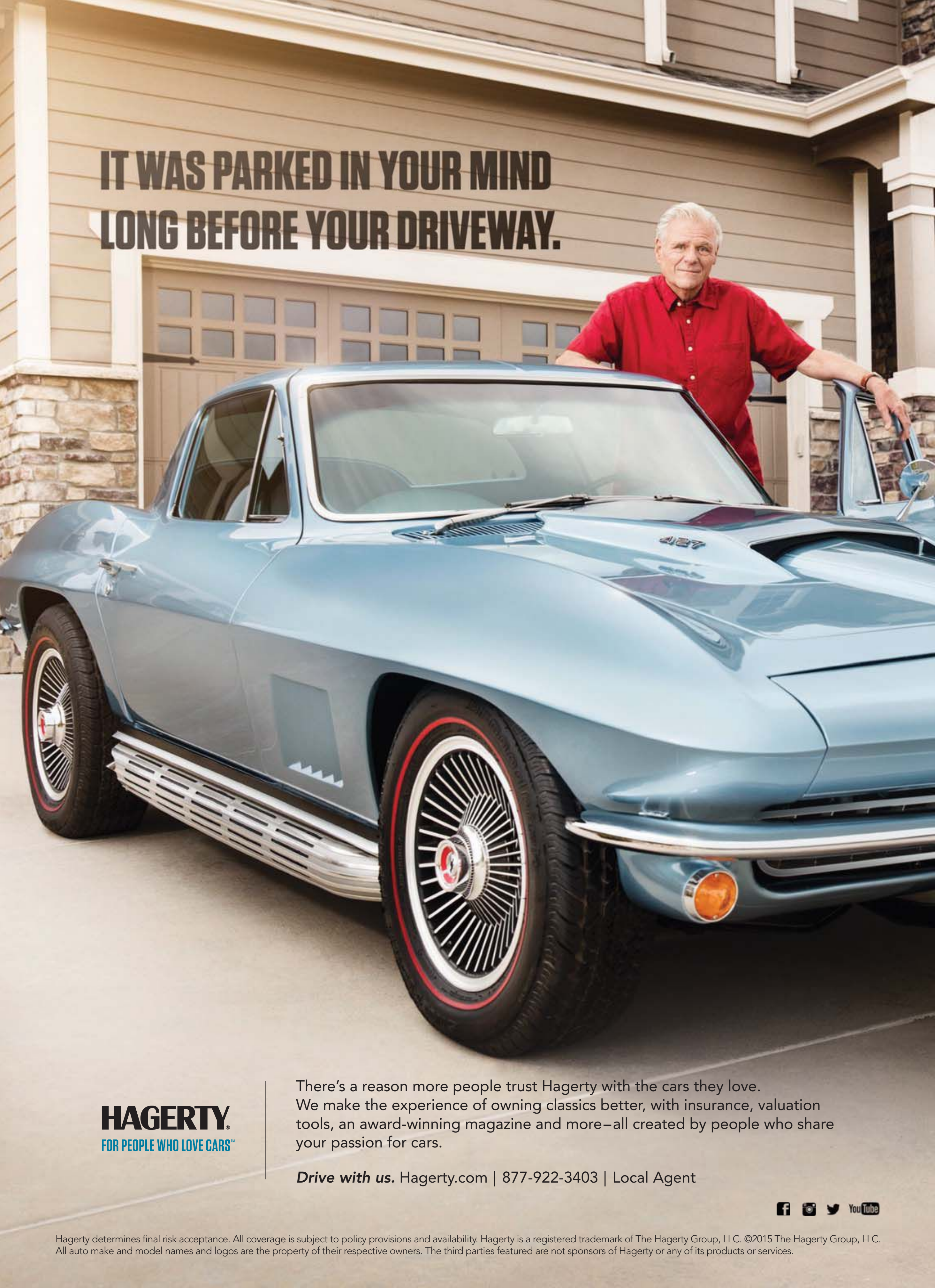

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